ANTI-FUZZY TRANSLATION AND ANTI-FUZZY MULTIPLICATION IN INK - ALGEBRAS

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Abstract: In this paper, we define a anti fuzzy translation and anti fuzzy multiplication on INK-algebras and discussed some of their properties in detail by using the concepts of anti fuzzy INK-ideal and anti fuzzy INK-sub algebra.

Keywords: Anti -Fuzzy-α-Translation, anti -Fuzzy-α-Multiplication of anti Fuzzy INK-Algebra, anti Fuzzy INK-Ideal, anti Fuzzy INK-Sub Algebra, anti Fuzzy

I INTRODUCTION

The concept of fuzzy set was initiated by L .A .Zadeh in1965 [4]. It has opened up keen insights and applications in a wide range of scientific fields. Since its inception, the theory of fuzzy subsets has developed in many directions and found applications in a wide variety of fields. The study of fuzzy subsets and its applications to various mathematical contexts has given rise to what is now commonly called fuzzy mathematics. Fuzzy algebra is an important branch of fuzzy mathematics. Fuzzy ideas have been applied to other algebraic structures such as groups ,rings, modules, vector spaces and topologies. In this way ,K.Iseki and S.Tanaka [1] introduced the concept of BCK-algebras in 1978. K. Iseki[2] introduced the concept of BCI-algebras in 1980. It is known that the class of BCK-algebras is a proper subclass of the class of BCI-algebras.T.Priya and T.Ramachandran [6][7] introduced the class ofPS-algebras , which is a generalization of BCI / BCK/Q /KU/ dalgebras.

In this paper, we introduce theconcept ofanti fuzzy-α-translation ,antifuzzy-α-multiplication of fuzzy INK-algebras and anti fuzzy extensions and established some of its properties in detail.

II.PRELIMINARIES

In this section we site the fundamental definitions thatwill be used in the sequel.

Definition:2.1[1] A BCK-algebraisanalgebra$(X,*,0)*$ of type$(2,0)$satisfying the following conditions:

i)$(x * y) * (x * z) \leq (z * y)$

ii)$x * (x * y) \leq y$

iii)$x \leq x$

iv)$x \leq y$ and $y \leq x \Rightarrow x = y$

v)$0 \leq x \Rightarrow x = 0$, where $x \leq y$ is defined by $x * y = 0$, forall x, y, z $\in$ X.

Definition2.2 [2]A BCI-algebra is an algebra $(X, *, 0)$ of type$(2,0)$satisfyi2ng the following conditions:

i)$(x * y) * (x * z) \leq (z*y)$

ii)$x * (x * y) \leq y$

iii)$x \leq x$

iv)$x \leq y$and $y \leq x \Leftrightarrow x = y$

v)$x \leq 0 \Rightarrow x = 0$, where $x \leq y$ is defined by $x * y = 0$,forall x, y, z $\in$ X.

Definition 2.3:[7]A nonempty set X with a constant 0 and a binaryoperation '*' is called INK– algebra if it satisfies thefollowing axioms.

1.$x*x = 0$

2.$x * 0 = 0$

3.$x * y = 0$ and $y * x = 0 \Rightarrow x = y$,$\forall$ x ,y$\in$X.

Definition 2.4:[7]Let S be a non empty subset of a INK-algebra X , then Sis called a INK-sub algebra of X if$x*y \in$S ,for all x ,y$\in$S.

Definition 2.5:[7]Let X be a INK-algebra and I be a subset of X, then I is called a INK-ideal of X if it satisfies following conditions:

1.$0 \in$I

2.$y*x \in$I and$y \in I \Rightarrow x \in$I

Definition 2.6:[6]Let X be a INK-algebra. A fuzzy setμin X is called a fuzzy INK-ideal of X if it satisfies the followingconditions.

i)$\mu(0) \leq \mu(x)$

ii)$\mu(x) \leq \max\{\mu(y * x), \mu(y)\}$, for all x, y$\in$X

Definition 2.7:[6]A fuzzy setμin a INK-algebra X is called a fuzzy INK-sub algebra of X if$\mu(x * y) \leq \max\{\mu(x), \mu(y)\}$, for all x, y$\in$X.

II. ANTI-FUZZYTRANSLATION AND ANTI –FUZZYMULTIPLICATION IN INK-ALGEBRA

   Let X be a INK-algebra. For any fuzzy set$\mu$of X, we define

$T = 1 - \inf\{\mu(x) / x \in X\}$, unless otherwise wespecified.

Definition 3.1:([3][5])Letμbe a anti fuzzy subset of X and$\alpha \in [0, T]$. A mapping

μ_α^T:

*	0	1	2	3
0	0	1	2	3
1	1	0	3	2
2	2	3	0	1
3	3	2	1	0

X$\rightarrow$[0, 1] is said to be a anti fuzzy-α-translation ofμif itsatisfies

$\mu_\alpha^T(x)$ =$\mu(x) + \alpha, \forall x \in X$.

Definition 3.2:([3][5])Letμbe a fuzzy subset of X and$\alpha \in [0,1]$. A mapping

μ_δ^M: X$\rightarrow$[0, 1] is said to be a anti fuzzy-α-multiplication ofμif it satisfies

$\mu_\delta^M(x)$ =$\alpha\mu(x), \forall x \in X$.

Example 3.3: Let X = { 0, 1, 2 ,3} be the set with thefollowing table.

Then (X,*, 0) is a INK–algebra.Define a fuzzy setμofXby$\mu(x) = \begin{cases} 0.5 & if\ x \neq 1 \\ 0.4 & if\ x = 1 \end{cases}$Then$\mu$ is a fuzzy INK-sub algebra of X.Here$T = 1 - \inf\{\mu(x) / x \in X\} = 1 - 0.5 = 0.5$,Choose

$\alpha = 0.2 \in [0, T]$and$\beta = 0.5 \in [0, 1]$.Then the mapping$\mu 0.4T$: X$\rightarrow$[0, 1] is defined by$\mu_{0.2}^T = \begin{cases} 0.5 + 0.2 = 0.7 & if\ x \neq 1 \\ 0.4 + 0.2 = 0.6 & if\ x = 1 \end{cases}$

which satisfies $\mu_{0.4}T(x) = \mu(x) + 0.4$, $\forall x \in X$, is a anti fuzzy 0.2-translation and the mapping $\mu_{0.3}{}^{M}(x) = \begin{cases} (0.5)(0.3) = 0.15 & if\ x \neq 1 \\ (0.4)(0.3) = 0.12 & if\ x = 1 \end{cases}$

which satisfies $\mu_{0.3}{}^{M}(x) = (0.3)\mu(x), \forall x \in X$, is a anti fuzzy 0.3-multiplication.

Theorem 3.4: If μ of X is a anti fuzzy INK-sub algebra and $\alpha \in [\ 0,T\ ]$, then the anti fuzzy-α-translation $\mu_{\alpha}{}^{T}(x)$ of μ is also a anti fuzzy INK-sub algebra of X.

Proof : Let x, y $\in$ X and $\alpha \in [\ 0,T\ ]$. Then

$\mu(x * y) \leq \max\{\mu(x\ ),\mu(\ y)\}$

Now $\mu_{\alpha}{}^{T}(x * y) = \mu(x * y) + \alpha \leq \max\{\mu(x\ ),\mu(\ y)\} + \alpha$

$= \max\{\mu(x) + \alpha, \mu(y) + \alpha\}$

$= \max\{\mu_{\alpha}{}^{T}(x), \mu_{\alpha}{}^{T}(y)\}$

Theorem 3.5: Let μ be a anti fuzzy subset of X such that the anti fuzzy-α-translation $\mu_{\alpha}{}^{T}(x)$ of μ is a anti fuzzy sub algebra of X for some subalgebra of X for some $\alpha \in [0,T]$. then μ is a anti fuzzy sub algebra of X.

Proof:

  Assume that , $\mu_{\alpha}{}^{T}$ is a anti fuzzy subalgebra for some $\alpha \in [0,T]$.

Let x , y $\in$ X. We have $\mu(x * y) + \alpha = \mu_{\alpha}{}^{T}(x * y)$

$\leq \max\{\mu_{\alpha}{}^{T}(x), \mu_{\alpha}{}^{T}(y)\}$

$= \max\{\mu(x) + \alpha, \mu(y) + \alpha\}$

$= \max\{\mu(x\ ),\mu(\ y)\} + \alpha \Rightarrow \mu(x * y)$

$\leq \max\{\mu(x\ ),\mu(\ y)\}$ for all x, y $\in$ X. Hence μ is anti fuzzy sub algebra of X.

Theorem 3.6: For any anti fuzzy INK-sub algebra μ of X and $\alpha \in [0,T]$, if the anti fuzzy-α-multiplication $\mu_{\alpha}{}^{M}(x)$ of μ is a anti fuzzy INK-sub algebra of X.

Proof: Let x, y $\in$ X and $\alpha \in [\ 0,T\ ]$. Then

$\mu(x * y) \leq \max\{\mu(x), \mu(y)\}$

Now, $\mu_\alpha{}^M(x * y) = \alpha\mu(x * y)$

$$\leq \alpha\max\{\mu(x), \mu(y)\}$$

$$= \max\{\alpha\mu(x), \alpha\mu(y)\}$$

$$= \max\{\mu_\alpha{}^M(x), \mu_\alpha{}^M(y)\}$$

$\Rightarrow \mu_\alpha{}^M(x * y) \leq \max\{\mu_\alpha{}^M(x), \mu_\alpha{}^M(y)\} \therefore \mu_\alpha{}^M$ is a anti fuzzy INK-sub algebra of X.

Theorem 3.7: For any fuzzy subset$\mu$of X and$\alpha \in [0,T]$, if the anti fuzzy-α-multiplication$\mu_\alpha{}^M(x)$ of$\mu$is a anti fuzzy INK-sub algebra of X, then so isμ.

Proof : Assume that$\mu_\alpha{}^M(x)$ of$\mu$is a anti fuzzy INK-sub algebra of X for some$\alpha \in [0,T]$. Let x , $y \in X$. We have

$\alpha\mu(x * y) = \mu_\alpha{}^M(x * y)$

$\leq \max\{\mu_\alpha{}^M(x)\mu_\alpha{}^M(y)\}$

$= \max\{\alpha\mu(x), \alpha\mu(y)\}$

$= \alpha\max\{\mu(x), \mu(y)\}$

$\Rightarrow \mu(x * y) \leq \max\{\mu(x), \mu(y)\}$.

Hence$\mu$is aanti fuzzy INK-sub algebra of X.

Theorem 3.8: If the anti fuzzy-α-translation$\mu\alpha T(x)$ of$\mu$is a anti fuzzy INK-ideal, then it satisfies the condition$\mu\alpha T(x * (y * x)) \leq \mu_\alpha{}^T(y)$.

Proof:$\mu_\alpha{}^T(x * (y * x)) = \mu(x * (y * x)) + \alpha$

$\leq \max\{\mu(y * (x * (y * x))) + \alpha, \mu(y) + \alpha\}$

$$= \max\{\mu(0) + \alpha, \mu(y) + \alpha\}$$

$\leq \max\{\mu_\alpha{}^T(0), \mu_\alpha{}^T(y)\}$

$=\mu_\alpha{}^T(y).$

Theorem 3.9: If μ is a anti fuzzy INK-ideal of X, then the anti fuzzy α-translation $\mu_\alpha{}^T$ of μ is a anti fuzzy INK-ideal of X, for all $\alpha \in [0,T\ ]$.

Proof : Let μ be a fuzzy INK-ideal of X and let $\alpha \in [0,T\ ]$.

Then $\mu_\alpha{}^T(0) = \mu(0) + \alpha \geq \mu(x) + \alpha$

$= \mu_\alpha{}^T(x)$

And $\mu_\alpha{}^T(x) = \mu(x) + \alpha \leq \max\{\mu(y*x), \mu(y)\} + \alpha$

$$= \max\{\mu((y*x) + \alpha, \mu(y) + \alpha\}$$

$$= \max\{\mu_\alpha{}^T(y*x), \mu_\alpha{}^T(y)\}$$

Hence $\mu_\alpha{}^T$ of μ is a anti fuzzy INK-ideal of X , $\forall \alpha \in [\ 0,\ T\ ]$

Theorem 3.10: Let μ be a fuzzy subset of X such that the anti fuzzy α-translation $\mu_\alpha{}^T$ of μ is a anti fuzzy INK-ideal of X for some $\alpha \in [0,T\ ]$, then μ is a anti fuzzy INK-ideal of X.

Proof: Assume that $\mu_\alpha{}^T$ is a anti fuzzy INK-ideal of X for some $\alpha \in [0,T]$.

Let x, y$\in$X. Then $\mu(0) + \alpha = \mu_\alpha{}^T(0) \leq \mu_\alpha{}^T(x)$

$= \mu(x) + \alpha$ and so $\mu(0)$

$\leq \mu(x)$

$$\text{Also,} \mu(x) + \alpha = \mu_\alpha{}^T(x) \leq \max\{\mu_\alpha{}^T(y*x), \mu_\alpha{}^T(y)\}$$

$$= \max\{\mu(y*x) + \alpha, \mu(y) + \alpha\}$$

$$= \max\{\mu((y*x), \mu(y)\} + \alpha \text{ and so}$$

$\mu(x) \leq \max\{\mu(y*x), \mu(y)\}$ Hence μ is a anti fuzzy INK-ideal of X.

Theorem 3.11: Let $\alpha \in [0,T]$ and let μ be a anti fuzzy INK-ideal of X. If X is a INK-algebra, then the anti fuzzy α-translation $\mu_\alpha{}^T$ of μ is a anti fuzzy INK-sub algebra of X.

Proof : Let x, y$\in$X .Now, we have

$\mu_\alpha{}^T(\mathrm{x}*\mathrm{y}) = \mu(\mathrm{x}*\mathrm{y}) + \alpha$

$\leq \max\{\mu(\mathrm{y} * (\mathrm{x} * \mathrm{y})), \mu(\mathrm{y})\} + \alpha$

$\leq \max\{\mu(0), \mu(\mathrm{y})\} + \alpha \geq \min\{\mu(\mathrm{x}), \mu(\mathrm{y})\} + \alpha$

$$= \max\{\mu(\mathrm{x}) + \alpha, \mu(\mathrm{y}) + \alpha\}$$

$$= \max\{\mu_\alpha{}^T(\mathrm{x}), \mu_\alpha{}^T(\mathrm{y})\}$$

Hence $\mu_\alpha{}^T$ is aanti fuzzy INK-sub algebra of X.

Theorem 3.12: If theanti fuzzy α-translation $\mu_\alpha{}^T$ of μ is a anti fuzzy INK-idealof X, $\alpha \in [0,\mathrm{T}]$, then μ is a anti fuzzy INK-sub algebra of X.

Proof: Let us assume that $\mu_\alpha{}^T$ of μ is aanti fuzzy INK-ideal of X.Then

$\mu(\mathrm{x} * \mathrm{y}) + \alpha = \mu_\alpha{}^T(\mathrm{x} * \mathrm{y})$

$\leq \max\{\mu_\alpha{}^T(\mathrm{y} * (\mathrm{x} * \mathrm{y})), \mu_\alpha{}^T(\mathrm{y})\}$

$\leq \max\{\mu_\alpha{}^T(0), \mu_\alpha{}^T(\mathrm{y})\}$

$\leq \max\{\mu_\alpha{}^T(\mathrm{x}), \mu_\alpha{}^T(\mathrm{y})\}$

$$= \max\{\mu(\mathrm{x}) + \alpha, \mu(\mathrm{y}) + \alpha\}$$

$$= \max\{\mu(\mathrm{x}), \mu(\mathrm{y})\} + \alpha$$

$\Rightarrow \mu(\mathrm{x} * \mathrm{y}) \leq \max\{\mu(\mathrm{x}), \mu(\mathrm{y})\}$

Hence μ is aanti fuzzy INK-sub algebra of X.

Theorem 3.13: Let μ be a fuzzy subset of X such that theanti fuzzy α-multiplication $\mu_\alpha{}^M$ of μ is a anti fuzzy INK-ideal of X for some $\alpha \in (0,1]$, then μ is a anti fuzzy INK-ideal of X.

Proof: Assume that $\mu_\alpha{}^M$ is a anti fuzzy INK-ideal of X for some $\alpha \in (0,1]$.

Let x, y $\in$ X.Then $\alpha\mu(0) = \mu_\alpha{}^M(0)$

$\leq \mu_\alpha{}^M(\mathrm{x})$

$$= \mu(\mathrm{x})$$

Also,$\alpha\mu(x)=\mu_\alpha^M(x)$

$\leq\max\{\mu_\alpha^M(y*x),\mu_\alpha^M(y)\}$

$$= \max\{\alpha\mu(y*x),\alpha\mu(y)\}$$

$=\alpha\max\{\mu(y*x),\mu(y)\}$

and so$\mu(x)\leq\max\{\mu(y*x),\mu(y)\}$Hence$\mu$is a anti fuzzy INK-ideal of X.

Theorem 3.14:If$\mu$is a anti fuzzy INK-ideal of X, then the anti fuzzyα-multiplication$\mu_\alpha^M$of$\mu$is a anti fuzzy INK-ideal of X, for all$\alpha\in(0,1]$.

Proof :Letμbe a anti fuzzy INK-ideal of X and let$\alpha\in(0,1]$.

Then$\mu_\alpha^M(0) =\alpha\mu(0)$

$\leq\alpha\mu(x)$

$=\mu_\alpha^M(x)$

And$\mu_\alpha^M(x) =\alpha\mu(x)$

$\leq\alpha\max\{\mu(y*x),\mu(y)\}$

$$= \max\{\alpha\mu(y*x),\alpha\mu(y)\}$$

$$= \max\{\mu_\alpha^M(y*x),\mu_\alpha^M(y)\}$$

Hence$\mu_\alpha^M$of$\mu$is a anti fuzzy INK-ideal of X ,$\forall\alpha\in(0,1]$.

Theorem 3.15:Let$\alpha\in[0,1]$and letμbe a anti fuzzy INK-ideal of a INK-algebraX. Then the anti fuzzyα-multiplicationμ_α^Mofμisa anti fuzzy INK-sub algebra of X.

Proof : Let x, y$\in$X .Now, we have

$\mu_\alpha^M(x*y) =\alpha\mu(x*y)$

$\leq\alpha\max\{\mu(y * (x * y)),\mu(y)\}$

$\leq\alpha\max\{\mu(0),\mu(y)\}$

$\leq \alpha \max\{\mu(x), \mu(y)\}$

$= \max\{\alpha\mu(x), \alpha\mu(y)\}$

$= \max\{\mu_\alpha{}^M(x), \mu_\alpha{}^M(y)\}$

Hence $\mu_\alpha{}^M$ is aanti fuzzy INK-sub algebra of X.

Theorem 3.16: Ifthe anti fuzzy α-multiplication $\mu_\alpha{}^M$ of μ is a anti fuzzy INK-ideal of X, $\alpha \in [0,1]$, then μ is a anti fuzzy INK-sub algebra of X.

Proof: Let us assume that $\mu_\alpha{}^M$ of μ is aanti fuzzy INK-ideal of X.Then

$\alpha\mu(x * y) = \mu_\alpha{}^M(x * y)$

$\leq \max\{\mu_\alpha{}^M(y * (x * y)), \mu_\alpha{}^M(y)\}$

$\leq \max\{\mu_\alpha{}^M(0), \mu_\alpha{}^M(y)\}$

$\leq \max\{\mu_\alpha{}^M(x), \mu_\alpha{}^M(y)\}$

$= \max\{\alpha\mu(x), \alpha\mu(y)\}$

$= \alpha \max\{\mu(x), \mu(y)\}$

   Hence μ is aanti fuzzy INK-sub algebra of X.

Theorem 3.17: Intersection and union of any two anti fuzzy translations of a anti fuzzy INK-ideal μ of X is also a anti fuzzy INK–ideal of X.

Proof: Let $\mu_\alpha{}^T$ and $\mu_\nu{}^T$ be two anti fuzzy translations of a anti fuzzy INK-ideal μ of X, where $\alpha, \nu \in [0, T]$. Assume that $\alpha \leq \nu$. Then by theorem 3.14, $\mu\alpha T$ and $\mu\nu T$ are anti fuzzy INK-ideals of X.

Now, $(\mu_\alpha{}^T \cup \mu_\alpha{}^T)(x) = \max\{\mu_\alpha{}^T(x), \mu_\nu{}^T(x)\}$

$$= \max\{\mu(x) + \alpha, \mu(x) + \nu\}$$

$= \mu(x) + \alpha$

$= \mu_\alpha{}^T(x)$ And $(\mu_\alpha{}^T \cup \mu_\nu{}^T)(x)$

$= \max\{\mu_\alpha{}^T(x), \mu_\nu{}^T(x)\}$

= max { μ(x) +α, μ(x) +ν}

= μ(x) +ν= $\mu_{\mathcal{V}}^{T}$(x)

Hence μ_α^T ∪ $\mu_{\mathcal{V}}^T$ and μ_α^T ∪ $\mu_{\mathcal{V}}^T$ are anti fuzzy INK-ideals of X.

IV.ANTI FUZZYEXTENSIONS OF INK-IDEALS OF INK-ALGEBRAS

In this section, we introduced the ofanti fuzzy extensions of INK-ideals of INK-algebras and proved some standard results.

Definition 4.1:Letμ_1 andμ_2 be two fuzzy sets of X such thatμ_2 is a anti fuzzy extension ofμ_1.Ifμ_1 is a fuzzy INK-ideal of Ximplies thatμ_2 is a anti fuzzy INK-idealof X, thenμ_2 is called as anti fuzzy INK-ideal extension ofμ_1

Theorem4.3:Intersection of any two anti fuzzy INK-ideal extensions of a anti fuzzy INK-idealμof X is a anti fuzzy INK-ideal extension ofμ.

Proof :Letμ_1 andμ_2 be two anti fuzzy INK-ideal extensions of a anti fuzzy INK-idealμof X. Thenμ_1(x) ≤μ(x) andμ_2(x) ≤μ(x),for all x∈X. Sinceμis aanti fuzzy INK-ideal of X,μ_1 andμ_2 are anti fuzzy INK-ideals of X. Thenμ_1 ∪ $\mu_2$is also a anti fuzzy INK-ideal of X (By theorem 3.4[6]).Now

(μ_1 ∪ μ_2)(x)= max{μ_1(x),μ_2(x) }≤max {μ(x),μ(x)}=μ(x). Henceμ_1 ∪ $\mu_2$is a anti fuzzy INK-ideal extension of μ.

Theorem 4.4 :Letμ be a anti fuzzy INK-ideal of X. The anti fuzzyα-translation μ_α^T is a anti fuzzy INK-ideal extension ofμ, for allα∈[0,T].

Proof :Ifμis a anti fuzzy INK-ideal of X, then by theorem3.11,theanti fuzzyα-translation μ_α^Tofμis also a anti fuzzy INK-ideal of X ,for allα∈[0,T]. Now μ_α^T(x) =μ(x)+α≥μ(x), for all x∈X. Hence, the anti fuzzyα-translation $\mu_\alpha^T$is a anti fuzzy INK-idealextension ofμ.

Theorem 4.5 : Letμbe a anti fuzzy INK-ideal of X. Ifα≥δ, withα,δ∈[0,T],then theanti fuzzyα-translation μ_α^Tofμis a anti fuzzy INK-idealextension of the anti fuzzyδ-translationμδTofμ.

Proof:Letμbe a anti fuzzy INK-ideal of X.Then by theorem 3.11,theanti fuzzyα-translation μ_α^Tofμand the anti fuzzyδ-translation μ_α^Tofμare anti fuzzy INK-ideals of X,

for all $\alpha,\delta \in [0,T]$. Since$\alpha \geq \delta, \mu(x)+\alpha \leq \mu(x)+\delta$, for all $x \in X$. Therefore $\mu_\alpha{}^T(x) \leq \mu_\alpha{}^T(x)$. Hence $\mu_\alpha{}^T$ is a anti fuzzy INK-idealextension of $\mu_\alpha{}^T$.

Theorem 4.6 :Letμbe a fuzzy setof $X, \alpha \in [0,T]$ and$\delta \in (0,1]$. Iftheanti fuzzy-δ-multiplication$\mu_\delta^M(x)$ ofμ is a fuzzy INK-ideal ofX, then the anti fuzzy-α-translation $\mu_\alpha{}^T(x)$ ofμ is a fuzzy INK-ideal extension ofμ_δ^M

Proof: Let$\alpha \in [0,T], \delta \in (0,1]$ and$\mu_\delta^M(x)$ of$\mu$is a anti fuzzy INK-ideal of X. Then by theorem3.13,$\mu$is aanti fuzzy INK-ideal of$X$. By theorem 3.9, $\mu_\alpha{}^T(x)$ of$\mu$is a anti fuzzy INK-ideal of X.Now,$\mu_\delta^M(x)=\mu(x) +\alpha \geq \mu(x) \geq \mu(x)\delta = \mu_\delta^M(x)$.Therefore, $\mu_\alpha{}^T(x)$ of$\mu$is a anti fuzzy INK-ideal extension ofμ_δ^M.

V. CONCLUSION

In this article authors have been discussed anti fuzzytranslation and anti fuzzy multiplication on INK-algebras through INK-sub algebras and INK-ideals.It has been observed that INK-algebras as an another generalization of BCK/BCI/Q/d/TM/KU-algebras.Interestingly, anti fuzzy extensions of INK-ideals of INK-algebras has been studied,whichadds an another dimension to the defined INK-algebras. This conceptcan further be generalized toIntuitionistic fuzzy set, interval valued fuzzy sets for newresults in our future work.

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TOTAL DOMINATION IN SUBDIVISION OF A BLOCK GRAPH OF GRAPHS

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Abstract

*For any graph G, **block graph** B(G) is a graph whose set of vertices is the union of the set of blocks of G in which two vertices are adjacent if and only if the corresponding blocks of G are adjacent. A **subdivision graph** of a block graph is obtained from B(G) by subdividing each edge of B(G). A dominating set $D \subseteq V[S(B(G))]$ is a total dominating set in $S(B(G))$ if the induced subgraph $\langle D \rangle$ has no isolated vertices in $(B(G))$. The total domination number of a subdivision of a block graph $S(B(G))$ is denoted by $\gamma_t[S(B(G))]$, is the minimum cardinality of a total dominating set in $S(B(G))$. In this paper, we obtain many bonds on $\gamma_t[S(B(G))]$, in terms of vertices, edges, blocks and different parameters of G and not the members of $S(B(G))$. Further we determine its relationship with other domination parameters.*

Subject Classification Number: AMS-05C69,05C70

Key words: Block graph, Subdivision graph, Total domination number.

1.INTRODUCTION

All graphs considered here are simple, finite, nontrivial, separable, undirected and connected. As usual, *p*, *q* and *n* denote the number of vertices, edges and blocks of a graph *G* respectively. For graph theoretic terminology we refer F.Harary [3]. Hedetniemi and Laskar in [5] studied connected domination and further connected domination number of a graph is studied by Sampatkumar and Walikar in [9]. As usual, the maximum degree of a vertex in *G* is denoted by $\Delta(G)$. A vertex *v* is called a cut vertex if removing it from *G* increases the number of components of *G*. For any real number *x*, $\lceil x \rceil$ denotes the smallest integer not less than *x* and $\lfloor x \rfloor$ denotes the greatest integer not greater than *x*. A graph *G* is called trivial if it has no edges. If *G* has at least one edge then *G* is called a nontrivial graph. A nontrivial connected graph *G* with at least one cut vertex is called a separable graph, otherwise a non-separable graph.

A vertex cover in a graph *G* is a set of vertices that covers all edges of *G*. The vertex covering number $\alpha_0(G)$ is a minimum cardinality of a vertex cover in *G*. An edge cover of a graph *G* without isolated vertices is a set of edges of *G* that covers all vertices of *G*. The edge covering number $\alpha_1(G)$ of a graph *G* is the minimum cardinality of an edge cover of *G*. A set of vertices in a graph *G* is called an independent set if no two vertices in the set are adjacent. The vertex independence number $\beta_0(G)$ of a graph *G* is the maximum cardinality of an independent set of vertices in *G*. The edge independence number $\beta_1(G)$ of a graph *G* is the maximum cardinality of an independent set of edges.

A nontrivial connected graph with no cut vertex is called a block. A subdivision of an edge *uv* is obtained by removing an edge *uv*, adding a new vertex *w* and adding edges *uw* and *wv*. For any (*p, q*) graph *G*, a subdivision graph *S(G)* is obtained from *G* by subdividing each edge of *G*. Here, a subdivision graph S(B(G)) is obtained from B(G) by subdividing each edge of B(G).

A set $D \subseteq V(G)$ of a graph $G = (V, E)$ is a dominating set if every vertex in $V - D$ is adjacent to some vertex in *D*. The domination number $\gamma(G)$ of *G* is the minimum cardinality of a minimal dominating set in *G*. A dominating set *D* is a total dominating set if the induced subgraph $\langle D \rangle$ has no isolated vertices. The total domination number $\gamma_t(G)$ of a graph *G* is the minimum cardinality of a total dominating set in *G*. For any non-trivial graph *G*, $\gamma_t(G) \geq 2$. A dominating set $D \subseteq V[S(B(G))]$ is a total dominating set in S(B(G)) if the induced subgraph $\langle D \rangle$ has no isolated vertices in S(B(G)). The total domination number of a subdivision of a block graph S(B(G)) is denoted by $\gamma_t[S(B(G))]$, is the minimum cardinality of a total dominating set in S(B(G)). This concept was introduced by Cockayne, Dawes and Hedetniemi in [2].

A set *F* of edges in a graph $G(V, E)$ is called an edge dominating set of *G* if every edge in $E - F$ is adjacent to at least one edge in *F*. The edge domination number $\gamma'(G)$ of a graph *G* is the minimum cardinality of an edge dominating set of *G*. Edge domination number was studied by S.L. Mitchell and Hedetniemi in [7].

A dominating set *D* is called connected dominating set of *G* if the induced subgraph $\langle D \rangle$ is connected. The connected domination number $\gamma_c(G)$ of a graph *G* is the minimum cardinality of a connected dominating set in *G*. For any connected graph *G* with $\Delta(G) < p - 1$, $\gamma(G) \leq \gamma_t(G) \leq \gamma_c(G)$.

In this paper, many bonds on $\gamma_t[S(B(G))]$ were obtained in terms of vertices, edges, blocks and other parameters of *G*. Also, we obtain some results on $\gamma_t[S(B(G))]$ with other domination parameters of *G*.

2.RESULTS

Initially we present the exact value of $\gamma_t[S(B(G))]$ for the Path graph P_p.

Theorem 1: For a Path graph P_p, $\gamma_t\left[S\left(B\left(P_p\right)\right)\right] = n$, where *n* is the number of blocks of the Path graph.

The following theorem relates between $\gamma_t[S(B(G))]$ and number of vertices of G.

Theorem 2. For any (*p, q*) graph *G*, $2 \leq \gamma_t[S(B(G))] < 2p$.

Proof. Let *D* be a γ_t-set of $S(B(G))$. By the definition of total dominating set, $\gamma_t[S(B(G))] = |D| \geq 2$. Hence, $2 \leq \gamma_t[S(B(G))]$.

For an upper bound, suppose $|E(G)| = q \geq p - 1$. If $|E(B(G))| = q'$ then $|E(S(B(G)))| = 2q'$ and $|V(S(B(G)))| > |V(B(G))| = n(G) < p(G)$. Hence, $\gamma_t[S(B(G))] < 2p$. That is, $2 \leq \gamma_t[S(B(G))] < 2p$.

In the following theorem, we obtain the upper bound for $\gamma_t[S(B(G))]$ in terms of blocks of G.

Theorem 3. For any connected graph G, $\gamma_t[S(B(G))] \leq 2n(G) - 2$. Equality can be obtained if $G \cong K_{1,2}, K_{1,3}, K_{1,4}$.

Proof. Suppose D be a γ_t-set of $S(B(G))$ and $\gamma_t[S(B(G))] = |D|$. Suppose n be the number of blocks of G. Then $B(G)$ has at least n vertices. Hence, $|V(S(B(G)))| \geq n(G)$. By the definition of total dominating set, D has minimum number of vertices of $S(B(G))$. Therefore, $\gamma_t[S(B(G))] = |D| \leq 2n(G) - 2$.

It is easy to check an equality, when $G \cong K_{1,2}, K_{1,3}, K_{1,4}$.

The next theorem gives the upper bound for $\gamma_t[S(B(T))]$.

Theorem 4. For any (p, q) tree T with $s(T) \geq 1$, $\gamma_t[S(B(T))] < 2q(T) + s(T) + 2$ where $s(T)$ is the number of cut vertices of T.

Proof. Let T be a tree with $q = p - 1 \Rightarrow p = q + 1$ edges and s cut vertices. Since $s(T) \geq 1 \Rightarrow 1 \leq s(T)$, from Theorem 2, $\gamma_t[S(B(T))] < 2p = 2(q + 1) < 2q(T) + 2 + s(T)$. This completes the proof.

Now we establish the relation between $\gamma_t[S(B(G))]$, $p(G)$ and $\Delta(G)$.

Theorem 5. For any graph G, $\gamma_t[S(B(G))] \geq \left\lceil \frac{p(G)}{\Delta(G)} \right\rceil$.

Proof: Let D_1 be a dominating set of S(B(G)) and $V_1 = V\left(S(B(G))\right) - D_1$ such that $V_1 \in N(D_1)$. Suppose $D_2 \subseteq V_1$ and $D_2 \in N(D_1)$, then $D_1 \cup D_2$ is a total dominating set of S(B(G)). Further, suppose $V' = \{v_1, v_2, v_3, \ldots, v_k\}$ be the set of all non end vertices in G, then there exists at least one vertex v of maximum degree $\Delta(G)$ in V', such that

$|D_1 \cup D_2| . \Delta(G) \geq p(G)$. It follows that, $\gamma_t[S(B(G))] \geq \left\lceil \frac{p(G)}{\Delta(G)} \right\rceil$.

We thus have a result, due to Ore [8].

Theorem A [8]: If G is a (p, q) graph with no isolated vertices, then $\gamma(G) \leq \frac{p}{2}$.

In the following Theorem we obtain the relation between $\gamma_t[S(B(G))]$, $\gamma(G)$ and $p(G)$.

Theorem 6: For any connected (p, q) graph G, $\gamma_t\big[S(B(G))\big] + \gamma(G) < \frac{5p}{2}$.

Proof: From Theorem 2 and Theorem A, $\gamma_t\big[S(B(G))\big] + \gamma(G) < 2p(G) + \frac{p(G)}{2} = \frac{5p}{2}$. Hence, $\gamma_t\big[S(B(G))\big] + \gamma(G) < \frac{5p}{2}$.

We have a following result due to Harary [3].

Theorem B [3, P.95]: For any nontrivial (p, q) connected graph G,

$$\alpha_0(G) + \beta_0(G) = p = \alpha_1(G) + \beta_1(G).$$

Further, we establish the following theorem.

Theorem 7: If G is a (p, q) graph, then

$$\gamma_t\big[S(B(G))\big] < 2(\alpha_0(G) + \beta_0(G)) = 2(\alpha_1(G) + \beta_1(G)).$$

Proof: From Theorem 2 and Theorem B, we get

$$\gamma_t\big[S(B(G))\big] < 2(\alpha_0(G) + \beta_0(G)) = 2(\alpha_1(G) + \beta_1(G)).$$

The following Theorem is due to V.R.Kulli [6].

Theorem C [6, P.19]: For any graph G, $\gamma(G) \leq \beta_0(G)$.

In the following Theorem, we develop the relation between $\gamma_t\big[S(B(G))\big], \gamma(G), \beta_0(G)$ and $n(G)$.

Theorem 8: For any connected (p, q) graph G, $\gamma_t\big[S(B(G))\big] + \gamma(G) \leq 2n(G) + \beta_0(G) - 2$.

Proof: From Theorem 3 and Theorem C, we get

$$\gamma_t\big[S(B(G))\big] + \gamma(G) \leq 2n(G) + \beta_0(G) - 2.$$

T.W.Haynes et al. [4] establish the following result.

Theorem D [4, P.165]: For any connected graph G, $\gamma_c(G) \leq 2\beta_1(G)$.

In the following Theorem, we develop the relation between $\gamma_t\big[S(B(G))\big], \gamma_c(G)\beta_1(G)$ and $n(G)$.

Theorem 9: For any connected (p, q) graph G, $\gamma_t\big[S(B(G))\big] + \gamma_c(G) \leq 2n(G) + 2\beta_1(G) - 2$.

Proof: From Theorem 3 and Theorem D,

$$\gamma_t[S(B(G))] + \gamma_c(G) \le 2n(G) + 2\beta_1(G) - 2.$$

The following upper bound was given by V.R.Kulli[6].

Theorem E[6, P.44]: If G is connected (p, q) graph and $\Delta(G) < p - 1$, then

$\gamma_t(G) \le p - \Delta(G)$.

We obtain the following result.

Theorem 10: If G is a connected (p, q) graph and $\Delta(G) < p - 1$,

$$\gamma_t[S(B(G))] + \gamma_t(G) < 3p - \Delta(G).$$

Proof: From Theorem 2 and Theorem E, we get

$$\gamma_t[S(B(G))] + \gamma_t(G) < 3p - \Delta(G)$$

The following Theorem is due to S.Arumugam et al. [1].

Theorem F[1]: For any (p, q) graph G, $\gamma'(G) \le \left\lfloor \frac{p}{2} \right\rfloor$. The equality is obtained for $G = K_p$.

Now we establish the following upper bound.

Theorem 11: For any (p, q) graph G, $\gamma_t[S(B(G))] + \gamma'(G) \le 2n(G) + \left\lfloor \frac{p}{2} \right\rfloor - 2$.

Proof: From Theorem 3 and Theorem F, the result follows.

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ANALYSIS ON PRACTICAL AND COMPUTATIONAL ASPECTS OF OPTIMIZATION THEORY

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ABSTRACT: Despite the way that the numerical techniques can be utilized to take care of the considerable number of problem-solving applications in the field of engineering with their optimization techniques. This technique derived from the approximation technique to reduce the additional error.These techniques are commonly beneficial for the various optimization method based on the analysis of limited elements. It shows the numerous calculations of the subordinates of the static relocations, the tensions, the Eigen values, the Eigen vectors and the transient reaction of the mechanical and auxiliary systems and so on. The idea of deterioration is shown, which allows the solution of an expansive optimization problem through the provision of smaller and easier to solve the problems. This article mainly discusses the concept of practical and computational implementation for the different analysis after utilization of optimization theory in this respect of various targeted solution. This kind of research mainly understood the optimization theory and computational technique to solve out all the function related to our context.

I. INTRODUCTION

The "Optimal" is Latin and signifies "the incredible perfect"; similarly, "optimus" signifies "the best". Along these lines, optimization alludes to the endeavor to achieve what we are managing its last state. We should investigate what it implies as far as model, and in the meantime bring the meaning of the term optimization, since the logical field comprehends it and utilizations it.

Mathematical optimization including numerical techniques, for example, linear and nonlinear programming, number programming, network stream hypothesis and dynamic optimization has its root in activities investigate created in world war II, e.g., Morse and Kimball 1950. The majority of this present reality optimization issues include various clashing objectives which ought to be thought about at the same time, purported vector-optimization issues. The arrangement procedure for vector-optimization issues is triple, in light of basic leadership strategies, techniques to treat nonlinear limitations and optimization algorithms to limit the objective capacity.

A) Subfields of Mathematical Optimization

- Linear programming (LP), a curved programming class, accentuates the situation where the target work f is direct, and the limitations are demonstrated utilizing just straight consistency and unbalance. This arrangement of necessities is known as polyhedron or polytope in the likelihood that it is constrained.
- Second Order Cones Programming (SOCP) is an arched program and fuses particular sorts of quadratic projects.

- Integer programming considers direct projects in which a few or the majority of the factors are compelled to be contrasted with the estimations of whole numbers. This isn't arched, and all in all it is considerably more dangerous than standard direct programming.

- Quadratic programming enables the target capacity to have quadratic terms, while the achievable set must be resolved with direct consistency and difference. For specific sorts of quadratic terms, this is a kind of arched programming.

- Conical writing computer programs is a general sort of arched programming. LP, SOCP and SDP can be viewed as tapered projects with the correct kind of cone.

- Convex programming Contemplate the circumstance when the target work is raised (minimization) or bend (augmentation) and the basic is curved. This can be viewed as a particular occasion of nonlinear programming or as a raised or straight quadratic programming theory.

- Semi-characterized programming (SDP) is a raised optimization subfield in which shrouded factors are semi-characterized systems. It is a hypothesis of straight and curved quadratic programming.

- Geometric writing computer programs is a framework whereby target and disparity requirements are imparted as postironies and correspondence limitations, since the monomials can be changed over into a raised program.

- Fragmentary programming contemplates advancing the connections of two non-straight capacities. The one of a kind class of packed divided projects can be changed to a raised optimization issue.

- Disjunctive writing computer programs is utilized when less necessities are to be met, yet not all. It is of explicit use in arranging.

- Programming necessities are a perspective on the programming scene in which the connections between factors are communicated as confinements.

- Compliance with the constraint thinks about the situation where the target work f is steady (this is utilized as a major aspect of the thinking made by man, particularly in modernized reasoning).

- Heuristics and met heuristics make practically zero assumption about refreshing the issue. Generally, heuristics don't guarantee that a perfect course of action is found.

- Stochastic optimization is utilized with assessments of discretionary (uproarious) capacities or sporadic passages in the following methodology.

- Vigorous writing computer programs is, as stochastic programming, a push to distinguish weakness in the essential data of the optimization issue. The incredible optimization centers around the revelation of arrangements that are real in any conceivable acknowledgment of vulnerabilities.

- Stochastic programming inspects the case in which part of the confinements or parameters depend on discretionary factors.

Space mapping is a thought for demonstrating and enhancing a plan structure for the exactness of the high-dedication (fine) display by abusing a sensible or by implication physically important model.

II. STATEMENT OF OPTIMIZATION PROBLEMS

The essential idea of mathematical optimization is to look for ideal answers for the optimization parameters under particular conditions, so as to accomplish certain criteria of fulfillment. It can subsequently be seen that the plan of specific optimization issue comprises of three essential components, to be specific optimization variable, objective capacity and requirement.

A fundamental and countless mathematical representation of a dynamic optimization issue has the accompanying structure:

$$\begin{aligned}
\underset{\mathbf{x}}{\text{minimize}} \quad & f_0(\mathbf{x}) \\
\text{subject to} \quad & f_i(\mathbf{x}) \leq 0 \qquad i = 1, \ldots, m \\
& h_i(\mathbf{x}) = 0 \qquad i = 1, \ldots, p
\end{aligned}$$

Problem portrays the procedure that limits the estimation of f0 (acquire least cost or greatest utility) by choosing the most ideal decision x subject to every one of the requirements. One practical elucidation of such detailing can be considered as a procedure of looking for the most ideal approach to put some capital in an arrangement of benefits, i.e., portfolio optimization. The variable x depicts the portfolio allocation over the arrangement of advantages. Every component in x speaks to the interest in a specific resource. The imperatives may comprise of a limit on the financial plan, the prerequisite of least ventures, and a base adequate estimation of expected return for the entire speculation. The optimization objective could be the risk of venture. For this situation, the optimization picks a portfolio profile that limits risk, among all conceivable obliged allocations.

III. PROBLEM SOLVING TECHNIQUES IN OPTIMIZATION THEORY

A) Techniquesof Reduced Basis

This is the type of optimal value reduction technique to reduce the value up to certain limit and optimal design of the structure of the project. This kind of techniques we have chosen the linear form equation which having the vector parameter X1, X2, …Xr. After the utilization of this design of the equation we evaluate and reduce the optimal value to the certain limit of extent. And this kind of optimization technique to solve out or design the vector quantity on this manner, linear equation written as follows:

$$X = c_1 X_1 + c_2 X_2 + \cdots + c_r X_r$$

Where c1, c2……...crare constants. In which we can utilized this constant parameter to solve out or optimization of various design value calculated as c1, c2,...,cr. This issue will have an extensively more modest number of inquiries since r «n. here the design vector would be written in the form of X1, X2………Xr to fill out the vector quantity. It very well may be seen that on the off chance that c1=c2=………. =cr=1/r, at that point X indicates the normal of the premise vector.

B) Techniques of Design Variable Linking

At the point when the quantity of components or people in a structure is tremendous, it is conceivable to decrease the quantity of task variables utilizing a framework known as an association with an undertaking variable. On the off chance that the cross-a sectional area of each part moves freely, we will have 12 project variables. Along these lines, once more, if symmetry is required on the vertical stick (Y), it tends to be accepted that the cross-territory domains of people 4, 5, 6, 8 and 10 are equivalent to those of people 1, 2, 3, 7 and 9, independently:

$$X = \begin{Bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{Bmatrix} = \begin{Bmatrix} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \\ A_6 \end{Bmatrix}$$

when the vector X is known, the near variables can be resolved as A4 = A1, A5 = A2, A5 = A2, A6 = A3, A8 = A7, A10 = A9 and A12 = 3A11. Portraying the vector of the considerable number of variables like

$$Z^T = \{z_1 z_2 \dots z_{12}\}^T \equiv \{A_1 A_2 \dots A_{12}\}^T$$

The connection among Z and X can be communicated as

$$\underset{12 \times 1}{Z} = \underset{12 \times 6}{[T]} \underset{6 \times 1}{X}$$

Where the matrix [T] is given by

$$[T] = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 3 \end{bmatrix}$$

C) Approach of Incremental Responses

Let the vector of separation of the structure or the machine, Y_0, identified with the heap vector, P0, is because of the arrangement of the agreement conditions.

$$[K_0]Y_0 = P_0$$

Or

$$Y_0 = [K_0]^{-1} P_0$$

where $[K_0]$ is the matrix of solidness as for the illustration vector, X_0, when the attracting vector is changed to $X_0 + X$, gives the framework's firmness matrix a chance to change to $[K_0] + [K]$, the vector of move to $Y_0 + Y$ and the heap vector to $P_0 + P$. The equilibrium conditions in the new design vector, $X_0 + X$, can be communicated as:

$$([K_0] + [\Delta K])(Y_0 + \Delta Y) = P_0 + \Delta P$$

Or

$$[K_0]Y_0 + [\Delta P]Y_0 + [K_0]\Delta Y + [\Delta K]\Delta Y = P_0 + \Delta P$$

APPROACH OF BASIC VECTOR

In the optimization, including the static response, it is possible to coordinate an inexact investigation in the changed illustrations with regards to the way that a specific number of right breaks down are created. This converts into huge time investment funds on PCs in light of the fact that, in numerous issues, the measure of design variables is much lower than the measure of adaptability in the structure. We considering the parity of equation of solution of structure as follows:

$$\frac{[K]}{m \times m} \frac{Y}{m \times 1} = \frac{P}{m \times 1}$$

where $[K]$ is the firmness matrix, and Y is the uprooting vector and P the heap vector. Give the structure a chance to have n design variables expected by the design vector.

$$X = \begin{Bmatrix} x_1 \\ x_2 \\ \vdots \\ x_3 \end{Bmatrix}$$

IV. OPTIMUM SOLUTION SENSITIVITY FOR THE PARAMETER OF PROBLEM

This is to incorporate the design the vector for the due course to be analyzed with outflow method.Any doubt, we will manage the information of the sensitivities or branches of the optimal (project variables and target work) as for the parameters of the issue. For the instance, consider the design of the base load of this section or structure of the machine subject to a constraint of the required weight. In this sense we can change and modification which we have needed to improve the parameters for the concern of the optimum solution sensitivity. When in doubt, branches of fondness utilize a constrained refinement technique. Regardless, this requires extravagant re-optimization of the issue utilizing expanded parameter esteems. In this way, it is intriguing to conclude the verbalizations for the various branches by utilizing the suitable equations.

V. CONCLUSION

It has been concluded that developing enthusiasm for the use of Optimization techniques for solving various problems has presented the capability of utilizing this best in class technology. Optimization techniques, not at all like strict mathematical strategies, have the obvious ability to

adjust to nonlinearities and discontinuities commonly found in many scenarios. The best-known algorithms in this class incorporate advancement programming, genetic algorithms, mimicked tempering, tabu pursuit, and neural networks. Over the most recent three decades numerous optimization techniques have been developed and effectively connected to the activity and control of electric power systems. This paper presents the mathematical foundation behind the algorithms utilized as a part of this book, without going profoundly into the mathematical evidences of these algorithms, to enable the peruser to comprehend the use of these algorithms. Distinctive illustrations are offered, where they are required, to enable the peruser to comprehend a particular optimization algorithm.

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ROLE OF INDIAN DIASPORA IN BUILDING NEW INDIA

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Abstract: The Indian diaspora is a conventional term to portray individuals who have emigrated from territories that are as of now inside the outskirts of the Republic of India. The great diaspora has assumed an essential job to advancing India's advantage abroad and in the job of unidentified represetatives. This is most imperative in the fields of culture, instruction, financial development, wellbeing and expressions of the human experience. Indians are pioneers in territories, for example, data technology and contribute a great deal to this. Most importantly, these IOPs can help India by putting resources into India's industry and framework to support its monetary development. In spite of the fact that the NRI commitment isn't unmistakable, they are helping your country through different exercises in India. Numerous reports uncover that NRIs are a vital wellspring of foreign direct investment, market development (outsourcing), technology transfer, charity, tourism, political commitments and progressively considerable learning streams in India. India must pursue a hearty and adaptable arrangement to misuse the qualities of the diaspora and limit the odds of any negative results. The diaspora can assume a vital job in India's journey to be an information control and a developed country. Currently, "PM Narendra Modi has a strong affinity towards the overseas Indian community, and it is witnessed in his every visit to a foreign country where he tries his best to interact with the Indian community at large." This article mainly focused on the "Role of Indian diaspora in building new India".

I. CONCEPT OF DIASPORA

The diaspora signifies "to scatter" in Greek, anyway today we utilize the term to depict a system of individuals living outside their country of source or basic heritage, yet we keep up powerful relationship with it. The Indian Diaspora is a nonexclusive term to depict the all-inclusive community that moved from territories that are currently inside the edges of the Republic of India. He likewise implies his relatives. The diaspora is presently assessed in excess of twenty million. It is made of "NRI" (Indian residents who don't live in India) and "PIO" (individuals of Indian beginning who have acquired the citizenship of some other country) and "SPIO". Stateless people of Indian source don't have archives that legitimize their Indian root (lion's share in Myanmar and Sri Lanka). The diaspora covers all parts of the world for all reasons and purposes. As shown by the UN, the Indians establish the biggest diaspora: in excess of 20 million Indians are dispersed all through the world. Today, there is no anomaly between being dependable subjects of the host country while proceeding to keep up social and social associations with one's own country.

India recently celebrated the 15th Pravasi Bharatiya Diwas (PBD) from January 21-23, 2019 in Varanasi, India to commemorate the efforts of the Indian Diasporas across the world[1-2].

As a commemorative event, PBD started back in 2003 under the leadership of former Prime Minister late Atal Bihari Vajpayee. January 7-9 of every year was selected to celebrate this event as January 9 is considered to be an important date in Indian history – it was on this day that Mahatma Gandhi returned back to India from South Africa – it was decided to celebrate this day in the name of the Indian Diasporas across the world[3].

This year too, India celebrated PBD but on different dates owing to a request made by the Indian Diaspora to attend the KumbhMela and the Republic Day celebrations in India while on their visit. The theme of the event this year was kept as "Role of Indian Diaspora in building New India".

Modi has successfully played to the Diaspora's emotions – they find in him a man of activity, somebody who can realize change in corruption-ridden, bureaucratic India; similar India they left numerous years back. Modi sees colossal potential in the Diaspora and is anxious to see them add to India's growth story. At the 2017 Pravasi Bharatiya Divas in Bengaluru, Modi declared that India is moving from "mind deplete to cerebrum gain", making his vision obvious — that "there is just a single dream (inside us all): Bharatiyata". The Pravasi Bhartiya Divas, 2017, was made on the topic out of reclassifying the dedication with Indians abroad, underlining the significance of the Indian diaspora in business, investment and the acknowledgment of the outskirts of the Swachh Bharat Mission, digital India and India just made. [4]

A. India's Engagement with the Diaspora

A government can understand a series of strategies to draw from its diaspora, from emblematic approaches to solids. Diaspora agreements in a country basically involve a set of state institutions, legal practices and legislative emanations defined to serve the interests of the extraterritorial population. Through these approaches, the nation of origin will try to profit from its diaspora, eliminating the accounts, mastering various types and the key impact. In India, these targeted activities include bilateral agreements to encourage the flow of migrants and money, changes in key financial regulations, state-supported expatriates and recognition of their achievements. These activities of the Indian government were not very organized and explained. The truth is said, for some time, especially in the midst of the routine of Nehru and Indira Gandhi, the government had been accused of being apathetic to the concerns of the Indian diaspora. This alleged indifference has often been considered a missed opportunity (Lall, 2010).. [5]

II. DIASPORA: FACTORS AFFECTING DEVELOPMENT OF INDIA

- **Remittances -** The fundamental focus regarding monetary effects of the diaspora in the country of source concerned its impressive money related responsibilities through settlements, the private transfers of vagrants to their families. As indicated by the World Bank, settlements can (I) diminish neediness in beneficiary families, spreading to different families; (ii) increment investment in training and wellbeing, just as other profitable exercises; (iii) decrease kid work; and (iv) increment enterprise. [6]
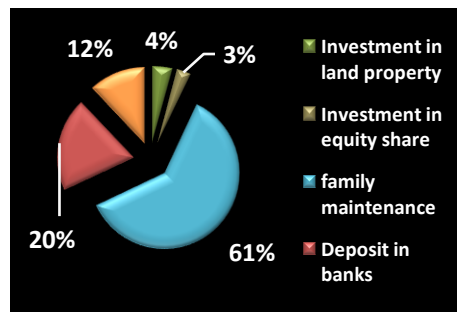
Source: RBI Bulletin April 2010[7]

Figure 1 Average used patterns of remittances in India

- **Investment -** Past remittances, diasporas are added to the monetary development of their country of inception through foreign direct investment (FDI) and the transnational pioneering soul, including support for business people, new organizations and free organizations in the country of birthplace. They could be compelled to put resources into financial matters that others may consider as high hazard, since they have preferred information and social open doors over the diverse speculators need. The components that have affected the diaspora of moving from their nations of starting point can impact the level of incorporation and responsibility in the development of their nations of root. [7] There are incredible differentiations between the incorporation of the diaspora in the development of their nations of birthplace and non-Diaspora FDI. To begin with, the manners of thinking and the case of diaspora investments are completely one of a kind contrasted with those of the conventional FDI. Diaspora investments can be driven by benefit goals just as long-haul examinations of structure a base in the nations of starting point. They will presumably be better instructed about the capacities and necessities of household work and the sort of planning required by nearby work. Available data recommends that his diaspora's investment in the Indian economy stays low. The all out whole of the investments of the Indian outcasts (NRI) in the period 1991-2001 is assessed at $ 2.6 billion of without a doubt the outright investment of $ 100 billion in India (Wei and Balasubramanyam, 2006: 3). [8]
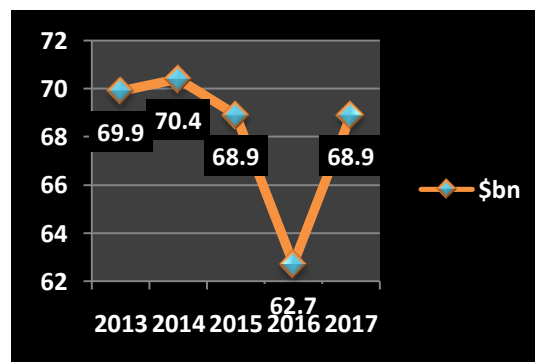

Figure 2 Remittance Flow of India

- **Diasporas' Knowledge Transfer -** In a situation where relocation energizes a transfer of human capital of a reasonably poor country of source to the acknowledged nations made, especially in the key divisions, for instance, instruction, wellbeing, correspondence and industry, the general feeling is that the influx of prepared authorities can dishearten interior efficiency, execute noteworthy long haul harm, diminishing endogenous economic growth and expanding irregularity as livelihoods increment the remainder of exceedingly qualified and less qualified specialists (ESCAP 2005, Todaro and Smith, 2006). Regardless, the ensuing and progressively hopeful points of view consider the perhaps direct, goals and worthwhile for returning transients, eventually, describing an aftereffect of mental grain; and qualified vagrants can send remittances, a noteworthy wellspring of extra cash that can ease credit necessities on human and physical capital investments (Rapoport, 2018).[9]

- **Diaspora Philanthropy -** One of the most basic structures that the diaspora adds to its nations of beginning is through selfless responsibility in numerous territories. Philanthropy has a critical assignment to do to advance worldwide esteem, acting past the most broad worries of the legislature and the minor interests of social orders. Social investments can give cash related assets, just as new aptitudes, clear thoughts and innovative approaches to handle worldwide issues. Kathleen Dunn (2012) [10] saw that "the philanthropy of the diaspora developed drastically in the twentieth century and the degree of aid ventures in case of cataclysmic events was defeated for a noteworthy social and budgetary asset for creating nations.

- **Diaspora Networks** - Another key piece of the impact of the diaspora on development are the "systems of the diaspora" that are found in writing as framework that cooperate with the individuals from the creating economy, with their insight and relationship of minimized by request of master learning and investment capital (Kuznetsov, 2006) [11]. How do these systems influence and why? The relocation suspicions have moved from income growth models to chance constraining systems. Particularly for diasporas, the impediment of the case must be possible through the systems. These community and diaspora systems don't serve just to help fleeting streams, yet additionally to influence and control access to explicit work markets. For the circumstance in India, we have seen this completely operational in the Gulf work markets. The systems of the diaspora work in some inventive courses, for instance amid the emergency and alleviation work.

- **Increase interest for Indian merchandise abroad** - The diaspora has catalyzed the enthusiasm of Indian items in their settlement nations. Items extend from nourishment, design to media outlets in India. This has extended the Indian rate, particularly in the region of hand weaving machines creates.

- **Diaspora Advocacy** - It is trusted that diaspora affiliations (and sometimes even individuals) become dynamically vocal and convincing in their nations of starting point and settlement. They are logically endeavoring to impact government, the media, the corporate part and other critical gatherings, and along these lines they are discussing an assortment of issues that influence their country of beginning. Sufficient procedures, establishments and assets should be built up to incorporate the gathering of individuals from the diaspora in national development exercises. There is frequently a major opening in the development press by

individuals in the diaspora who need to build up the neighborhood community and the vision of community development. In this sense, there ought to be an authentic comprehension and an organized exertion between them to accomplish an extraordinary change.

III. CURRENT POLICIES OF DIASPORA

The government's drives towards the Diaspora are two dimensional. For one, they consider the necessities of NRIs and OCIs by furnishing them with consular services, assurance and lead outreach exercises to draw in with them. In the meantime, they decide to urge the Diaspora to add to India's growth through philanthropy, knowledge transfers, and investments in advancement and help with other development projects.

In light of this, the Modi government has launched a string of activities and repackaged old schemes, for example, the 'Realize India Program' (KIP). The most recent three years saw the dispatch of Head Post Offices as visa focuses empowering thousands more to apply for an international ID. For those hoping to travel to another country, training focuses, and orientation programs are given to prepare future representatives on significant skills and minimize culture shock. [12]

Various arrangements were reported remembering the security of welfare and enthusiasm of Indians abroad. For instance, the 2014 Minimum Referral Wages (MRW), pertinent just to Emigration Check Required (ECR) countries, expanded the lowest pay permitted by law of Indian workers utilized as industrial workers, domestic servants, cleaners and workers. To somewhat lessen the danger of vulnerability from fraudulent contracts, nurses for instance can now just be enlisted through one of the six state government placement agencies. Besides, in 2015, the Ministry of External Affairs launched the e-move framework that requires every foreign boss to enlist in the database. These strategies are a positive development yet have confronted analysis from countries like the UAE who guarantee it is a "breach of our sovereignty". [13]

The fruitful KIP, launched in 2003 by Atal Bihari Vajpayee, has been refashioned to incorporate more participants and sessions consistently. In the event that in 2006 India facilitated 55 participants crosswise over two sessions, in 2017 it facilitated 160 participants crosswise over four sessions. [14] The occupant government additionally launched a site that empowers participants to apply online. The program is pointed for the most part at Girmitiya youth and gives a chance to them "to more readily comprehend and acknowledge contemporary India, foster nearer ties with the place that is known for their progenitors and upgrade their engagement with India". [15] Homeland visits or Diaspora the travel industry is seen by a few researchers as an essential to contribute helpfully to the home nation. In perspective of the above mentioned, concentrating on Girmitiya youth is successful as most participants visit India for the first time through the program. In the end, the thought is to form them into unofficial ambassadors of India.

Other youth-driven effort programs incorporate grants to seek after college classes in perceived University Grants Commission universities in India, just as Bharat KoJano online tests that test the participants' knowledge of India's legacy, history and culture. The debut test in 2016 saw the

interest of somewhere in the range of 5,000 diaspora youth. To be sure, Prime Minister Modi is attempting to understand Vajpayee's dream of a solid Pravasi, yet on a bigger scale. In the PravasiBharatiya Divas (PBD) that has been composed since he progressed toward becoming PM Modi has been enthusiastic about charming the Diaspora. However, it very well may be contended that the PravasiBharatiya Divas have nearly turned into a show where he allures wealthy Diaspora, frequently disregarding the individuals who truly add to India. The significance and productivity of such a festival is in this manner faulty. Be that as it may, not for Modi, who keeps on survey PBD as a chance. To additionally underline the significance of their commitments, he has devoted a working in New Delhi to them—called the PravasiBhartiya Kendra. These delicate strategies make an effect for a Diaspora that has frequently felt ignored. However, an expanded focus on the Diaspora accompanies its own challenges.

IV. IMPACT OF DIASPORA ON DEVELOPMENT: PAST AND PRESENT

In the first decades after freedom, mostly in the mid-1950s until the 1960s, some post-colonial countries, including India, followed a closed model of country building and development planning. The essential goal of these governments was to protect the economic interests of these new emerging countries from the indifference of being over-presented to the outside world and being excessively subject to external resources to build their growing economies. The development models that were received were fundamentally based on internal consolidation and the slow movement towards confidence in different sectors of the economy. There was a strong emphasis on the development and consolidation of a country and regionally determined residents who could secure privileges and participate during the "reproduction or national development" time. In this patriot talk of development, the Society who was not remaining inside the regional limits of the country, named freely as Diasporas, was seen with a specific fear for their absence of responsibility to the country they had once lived in.

This would change with the procedure of globalization, with its intense flows of wares, work and capital, and phenomenal dimensions and methods for communication. Put in an unexpected way, globalization has added to an advantageous connection among countries and transnational flows of human creatures and capital. New diasporic communities, with their connections to numerous national locations, economies and cultures encouraged by new innovations, have turned out to be vital shapes of the 'new, post-national cartography' of the worldwide world.

As the effect of globalization contacts more individuals than any other time in recent memory, the job and impact of Diasporas in development are ending up progressively imperative in strategy and at times, legislative issues. The comprehension of the association among migration and development depends on the picked hypothetical model and on how the affiliation presents itself. There are two alternate points of view on the connection among migration and development. The fundamental assessment is the "adjusted growth" approach. [16]

- First, the effect of the diaspora on development, regarding transfers of family remittances; demand for administrations, for example, broadcast communications, purchaser products or travel; capital investment; and unselfish blessings to generous affiliations (Brinkerhoff, 2008: 208). [12]

- Secondly, development impacts migration, as in a closer economic compromise symbolized by increasingly liberal trade and investments can quicken change in creating nations, affecting the components of universal migration.

V. DIFFERENT SECTORS DEVELOPED BY THE INDIAN DIASPORA

The impact of diasporas in economic development has various estimations that are especially felt in three territories: investments can incorporate foreign direct investment (FDI); Indirect investment (portfolio) through offers, securities and store accounts; and the growth of unequivocal segments, for instance, the movement business or data technology through strategies other than direct investment.

A. *Diaspora helped in Developing the Trade*

The proof of strong associations between the closeness of a diaspora living in a country and the business associations with the country from which the diaspora started has been step by step included. A Canadian exchange study with 136 complicit nations in the period 1980-92 demonstrated that a 10% immigration development of a particular country was identified with the 1% extension in rates to that country and an expansion in 3% in imports of it. Equivalent research from the United Kingdom and 48 exchanging accomplices, and from US rates to 28 nations of starting point, additionally discovered solid associations between the vicinity of a diaspora and extended exchange. The populaces of the diaspora eat up the result of their nations of beginning and relate these components to their settlement country. Since El Salvador, for instance, Diaspora buys of conventional items from El Salvador speak to up to 10 percent of the country's outright rates, as Manuel Orozco demonstrates.

B. *Diaspora helped in Developing the Investment*

Diasporas take twofold similar work as for investments, either by putting directly in their nations of cause or by persuading non-diasporic financial specialists to do likewise. A test dispersed by the World Bank has mapped the heaviness of African transients in the nations of the Organization for Economic Cooperation and Development (OECD) against the investments of these nations in the nations of starting point of vagrants and has discovered a strong flag that the nearness of transient systems increments both direct investments and portfolio investments.

The presentation of people from the diaspora regularly improves the notoriety of the country of cause and offers financial specialists more noteworthy trust in the idea of their working force and business condition; Furthermore, the people of the diaspora who achieve the spots of administration in an association wind up in a circumstance that drives foreign investments towards the country where they know the language, culture and corporate systems well. The noteworthy number of abnormal state authorities of Citigroup's Indian inception has lessened its concentration to wind up one of the two biggest foreign banks working in India.

C. *Diaspora helped in Developing the Skills and Knowledge Transfers*

For certain nations, the diaspora creates as a psychological certainty, partner the crucial pieces of society all in all and the private segment with a space that isn't available in the country and remunerate a little for the flight of especially qualified vagrants. A few aptitudes transfer

capabilities and exercises rely upon the change. (Furthermore, here and there, unaltered) the arrival of individuals prepared by national beginning to educate and plan, notwithstanding the way that these exercises are hard proportional in view of its mind-boggling expense and the trouble of separating the diasporas experienced in their typical occupations at abroad for imperative occasions.

D. The diaspora has added to the development of the data technology segment.

The instances of explicit areas of the creating economies that have profited by the investment of the diaspora are too extraordinary to even consider thinking of portraying them thoroughly here. All things considered, numerous individuals know about crafted by the Indian diaspora in the development of the data technology division in India, driven by the accomplishment of Indian designers and business visionaries in Silicon Valley.

E. Diaspora has added to the development of the private emergency clinic division.

The private clinic segment is another region where the Indian diaspora has revived its growth, joining medicinal tourism. Pratap Reddy, an Indian cardiologist who was practicing in the United States, came back to India and opened a 150-bed private emergency clinic in Chennai in 1983. From that minute on, his Apollo Group Hospitals developed to 8,500 beds in 50 emergency clinics (seven of which have Joint Commission International accreditation) and is one of the biggest health care bunches in Asia. The Apollo clinic arrange drove telemedicine to give brilliant consideration to urban areas in India, just as computerized therapeutic strategies and medicinal tourism. He drove the vertical consolidation of restorative administrations, from health protection to medical clinic association and indicative administrations, among numerous others. Besides, it is likewise unique in general health exercises to advance heart health and numerous other humanitarian ventures.

F. The diaspora has added to the development of therapeutic administrations and advancements.

In many creating nations, for instance, in India, medicinal callings have felt weak to prepare and keep up an adequate number of health specialists with the correct abilities. In certain nations, the health structure is wastefully financed that health care specialists who need a great deal of consideration can't locate some sort of work or don't approach the kind of preparing that will enable them to perform expertly in a strange condition. Medicinal experts who have been chased for preparing and have been tried abroad can bring new instruction, aptitudes, hardware and information (e.g. clinic association) to their nations of inception, assets they would not have had the capacity to accomplish. They remained at home. People in the diaspora in the second and last age can likewise willfully offer their administrations and help bolster restorative administrations and advancement in their tribal homes.

G. Diasporas added to the advancement of worldwide businesses.

In every one of these districts of diaspora action, the Indian government was a minor player, albeit most organizations took off when India began its economic advancement program in 1991. The administration figured out how to empower the Diaspora investments through and to an

expansive degree, for instance, to make a "one-stop shop" to improve bureaucratic and dictator prerequisites for diaspora financial specialists.

As of late, to advance India's circumstance in the jewel business, even with China's developing test, the legislature has made some abnormal economic zones to energize exchange. (India does not extricate numerous precious stones, so it must import hard jewels and 90% of its yield of cut jewels and jewel embellishments is sent). India is a genuine instance of the work that diasporas can do in progressing worldwide issues and the recognition that diasporas by and large don't trust that the administration's methodology is perfect before it increases. Regardless, India likewise speaks to that administrations can advance development via completing unequivocal exercises to enable the diaspora to put resources into economic parts with high growth potential.

VI. STEPS TAKEN BY INDIAN GOVERNMENT TO TACKLE THE HARNESS BENEFITS OF INDIAN DIASPORA

- India is one of the pioneers in seeing the significance of its foreign populace and in building up an institutional structure for a reasonable and commonly useful pledge to its diaspora. India in this manner sees the need to transmit an imperative measure to its responsibility to its community abroad. It endeavors to make an affiliation that best serves India as a quickly creating knowledge economy, to promote business enterprise and fulfill the desires of the Indian community abroad as an expansive gathering far and wide.

- The Facilitation Center for Indians Abroad (OIFC), a non-income driven trust in a joint effort with the Confederation of Indian Industry (CII), to finish the budgetary responsibility, investments and business

- The India Development Foundation (FID), a non-income driven trust to be finished as a solitary trust to support magnanimous diaspora and bring India's altruistic capital abroad into India's social development exertion window.

- India's Center for Migration (ICM), a non-income driven society that is coordinated as a "gathering of specialists" key issues distinguished in foreign work markets for Indians and Indian laborers abroad.

- Global Indian Knowledge Network (Global-INK), a strong electronic stage that will promote the transfer of knowledge with the point of utilizing the skills, capacities and experience of Indians abroad.

- The Prime Minister's Global Advisory Council, which is incorporated as an unusual express office's capacity to exploit the best Indian identities abroad, wherever they live.

- The PravasiBhartiya Divas (PBD) - The convention of PravasiBharatiya Divas is made each year since January 2003, with a definitive objective of interfacing India with its incredible Indian diaspora and bringing their knowledge, skills and capacities into one regular situation.

VIII. CONCLUSION

This research has appeared current position recorded as a hard copy on migration in this issue, which appears in practice the solid ties, the consequences of this methodology demonstrate that a) the significance of different sorts or gatherings of diasporas may contrast, it is no vulnerability of potential, in any case, there is no assurance of an "undeniable connection". Subsequently, immense undiscovered potential remains, and test routine makers depend on making an energizing situation and joining diasporas/migration in the general development process.

The impact of the new duty of the diaspora with India is hard to examine, on the grounds that it is hard to separate the reasons for relationship nonsensically and to assess the impact of tough products, for example, the transfer of knowledge and skills. What can't be denied is that administrations can accomplish more to push obstructions and open entryways for diasporas to take an interest in economic development, making exercises express to get where and who the diaspora populaces, assemble solid partnerships with accomplices diaspora and urge their commitment to the country of beginning, combined their feeling of having a spot and meeting balanced reason for actualizing strategies that include the diaspora. We likewise understand that the arrangements of the diaspora work best when diasporas are verified as full accomplices, in a manner of speaking, when the responsibility of the diaspora is a two-way road. This is why India needs to move forward with the vision of connecting more with its diaspora around the world. Narendra Modi in his tenure as Prime Minister of India laid the foundations in a more welcoming way for the Indian diaspora.

It's the time when we should all appreciate our Diaspora in different parts of the world for all the laurels,it bring to our country by performing exceptionally well in any sector they are into. It's the time when we all should move ahead to capture the potential of our Diaspora in a constructive way that brings name, fame and development for India at the global level.

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PARADIGMS OF CORPORATE CRIMINAL LIABILITY

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ABSTRACT: The article covers the review of corporate criminal risk under the Indian law. Corporate Crime is an office wrongdoing; yet is of a specific kind. Corporate crime is an authoritative wrongdoing happening with regards to complex connections and desires of Board of Directors, Executives and Managers and on the other hand by its other employees. This type of corporate crime has developed gradually over the years. Collectives or aggregates of discrete individuals enact corporate crime. This article illustrates the number of lacks and obstacles in jurisprudential and legal acts for the corporate crimes that prevent in judgement. This article explains the statutory inadequacy for the jurisprudence for the criminal jurisprudence and less significance. It elaborates censure and rebuff one individual for the behaviour of another without reference to whether the previous was at shortcoming of what happened in the setting of corporate criminal law. Also, this article explains present legal and economic set up a unique procedural component is expected to manage corporate criminal liability. In last concludes the research and suggest for the future research.

KEYWORD: Corporate Criminal liability, Jurisprudence, criminal law

I. INTRODUCTION

A corporation is an alternate genuine element developed through some institution or enlistment get ready. They have rights and liabilities disconnect from that of their investors. A portion of these organizations have assets and workplaces in various countries isolated from their country of birthplace additionally and such ventures are known as Multinational Corporations (MNCs). Multinational Companies have come to accept a giant part in numerous pieces of human life today. Their powers have created at a shocking rate over the span of the latest couple of hundreds of years, to such a degree, that they are much of the time appeared differently in relation to entire nations. Subsequently, driving some sort of methods for responsibility and authority over these multinationals and organizations is of crucial significance and should be to an extraordinary degree high on the summary of requirements for every country.

This research is entitled on 'Corporate Criminal liability: Jurisprudence and its centrality in Indian Context' which is a standout amongst the most noteworthy subjects in the train of present-day Criminal Law. The two key subjects of this examination are:

(i) The theoretical elements which in the business world are known as Companies or Corporations, and

(ii) The threat of another sort of crimes which is known in the domain of criminal statute as corporate crimes. In an investigation of this kind it is important to note all things considered the occasions which have since occurred as to the previously mentioned organization and the way of violations connected with this specific establishment

Definition of Corporate Criminal Liability

Corporate crime implies violations submitted either by an enterprise, or by a person that might be related to a company. A corporate crime is the demonstration of its own and need not be approved or confirmed by its authorities. It is adequate if the authorities were practicing standard powers for the benefit of the company. In this way to significant degree, the crime of the company is entwined with the demonstrations of its authorities. Such criminal acts are intelligent of the character of the people who deal with the corporation.

I have presented in section 1 that the corporate criminal liability had its inception in the old law and transformed among point of convergence of the doctrinal dialogs toward the finish of the nineteenth century. Its history, laws, money related aspects, and political issues interesting to every nation have impacted assembling and change of the possibility of corporate criminal liability.

II. OBJECTIVES

The Corporate Criminal Liability for law and its hugeness and the goals are following:

- To Study essential control of criminal liability in India.
- To Research and break down the sorts of Corporate Crimes in India.
- To inquire about on the difficulties and deceitful of the Corporate in India.
- To find the quantity of endorse for the distinctive sorts of corporate crimes and fake.
- To inquire about on the statute criticalness for corporate wrongdoing for finding out the discipline being given to the criminal.
- To consider the lawful acts made for the corporate wrongdoing in India.
- To find the Criminal Liability of Corporate and impact of the activities of corporation.
- To explore the Statutory Inadequacy for the law for criminal law.
- To find the snag in the criminal law.
- To find the diverse sorts of need in the jurisprudential and lawful acts for the corporate crimes and recommend number of corrections ought to be made in legitimate acts for corporate violations.
- To find the centrality of Jurisprudence for Corporate Criminal Liability.

III. HYPOTHESIS

1. The organization is not made criminally subject for the most part on the ground that it can't have the essential mensrea.

2. Corporate crimes are a result of the showings and deeds of either individuals or they don't straightforwardly happen in light of the organization itself.

3. There is statutory inadequacy for the law for the criminal law and less noteworthiness.

4. There are number of needs in jurisprudential and legitimate acts for the corporate crimes that anticipate in judgment.

5. There are number of deterrents in the corporate criminal law that deters the Indian legal framework in judgment.

6. The Indian statute on the corporate criminal risk is constrained to a couple cases.

7. The Indian case law does not have any assertion to a single model of the corporate criminal hazard.

8. The organization can well be associated with criminal commitment. The courts are prepared for fastening regular hazard between the organization and the authorities included.

9. In the framework of corporate criminal law, it was out of place to blame and reject an individual for the conduct of another without reference to the fact that the past was lacking in what was happening.

10. The corporate must have quite supported the commission of the offense in one of two ways. The corporate society may have achieved the wrongdoing to happen, either on the grounds that the offense was coordinated or because the method for the lifestyle drove its reward.

11. The legal built up a statute to charge corporations of crimes of intent. It is the introduction of vicarious liability and distinguishing proof doctrine combination.

12. An organization can be indictable for the offenses, for example, plural marriage, prevarication, assault which must be conferred by a human individual or for offenses punishable with confinement or corporal order.

13. In India, the regular implementation part isn't as viable and able as the criminal requirement system. It slants towards the capable segments like endeavour should, in any case, much as could be normal remain inside the firm hands of a criminal circle.

14. Under the present lawful and monetary set up a one of a kind procedural section is relied upon to oversee corporate criminal liability.

IV. VISION

This article pursues the source and the last choice of the courts concerning the possibility of a corporate criminal commitment and, moreover, clarifies the impotence of the court to really condemn the guilty parties of the companies due to the inadequacy of the law. [1]. The law has bound the Courts to force just fine as a type of the discipline for corporate which should be explained by developing and consolidating new types of the disciplines upon the corporate with

the end goal that the genuine reason for disciplines. With this article, we are explaining the types of crimes made in the corporation, the way to recover from it, and then also suggest the number of punishments.

V. CRIMINAL LAW JURISPRUDENCE

The jurisprudence of criminal law [2] relating to the burden of criminal risk for associations is resolved in the sense that companies can violate the laws and, therefore, be legally bound. However, the resolutions in India do not live up to these advances and the previous exam shows that they do not make associations in criminal danger and paying little heed to the likelihood that they do all things considered, the rules and lawful understandings constrain the same trains aside as fines. Beside fines, disciplines, for instance, winding up of the association, to momentary finish of the corporate, considerable compensation to the setbacks, by wandering on the shortcoming of the organization i.e., its generosity, etc. Such methods for the control will obstruction influence the corporate and the sole purpose of order under criminal law would be practiced.

VI. MAJOR OVERSEE OF CRIMINAL LIABILITY

The major supervise of criminal liability pivots the fundamental Latin saying "Actus non facitreum, nisi mensrea"[3]. It proposes that to make one in peril, it must be displayed that show or oversight has been done which was unlawful and has been finished [4]. This is the continuation of criminal responsibility which, in a specific way, still makes sense, if all else fails, the execution with which duty is initiated is the self-organization of the person, who transmits that the problem of commitment In an individual flow it is usually due to the possibility of resolving judicious decisions. on activities and behavior [5].

Despite the way that typical process remains the same as the previous one, it is relevant to every criminal case. However, the criminal law has seen a wonderful case in relation to the thought mentioned above in a class of grave responsibility heading in which it can be subject without restrictions. blame the prospect [6]. It happens in events of the mass poundings through sullying, net remissness of the affiliation recognizing broad harms like in the Bhopal Gas fiasco Case. Subsequently, there can be no practical discussion in constraining criminal liability on corporate despite when there is no mensrea[7].

VII. EVOLUTIONS OF THE CONCEPTS OF CORPORATE CRIMINAL LIABILITY

The courts of England and the United States to criminal liability of companies first limited to cases that do not include semi-open businesses, for example, areas that have managed to open the irritations.

1. **Crimes not requiring criminal intent**– With the proximity and importance of the created corporations, the courts extended the corporate criminal responsibility for the aggravation open to all crimes that did not require a criminal desire [8]. This progress, with the passage of

time, requires that the courts extend the criminal liability of the companies to all violations that do not require expectations.

2. **Crimes of intent –**The courts have again extended the criminal liability of companies to violations of desire. The inducing segment in regard to the outcome was the essential for sensible utilization of law against organizations. Creation of corporate identity had, all around, made too much broad a vacuum backwards utilization of criminal law to organizations.

3. **Expansion of corporate criminal liability –** The clear and distinctive changes in Western Europe and the United States have also contributed to the change and development of corporate criminal responsibility. [9]. Regardless, a champion among the most fundamental factors favoring criminal liability over primary liability was that general society essential experts did not have as much prerequisite control as criminal implementers did.

VIII. ACTIVITIES

Corporate Crime and Legal Entity

It is wrangled about most of the occasions; paying little mind to whether it is conceivable to consider in charge of a wrongdoing a non-normal substance, for example, A corporate body which not in the littlest degree lean towards a specific individual isn't set up for motivation for itself or of making any desire for its own. Likewise, he thinks that the general idea of guilt and regular responsibility in the probability of a company's criminal responsibility is a moral obligation [10]. It is a section that a theoretical substance, for example, needs a corporate body. The business element has no physical proximity to the side of the mortar structures and does not have an autonomous perspective. It moves what it does or shows that it strives and the thought that happens on these occasions is characterized by its leaders or authorities. There is the opinion that, faced with the threat, the workers of the company must stun.

Mens Rea In Corporate Liability

In any case, nowadays, when the parts of the exhibitions made by an association are limited to understanding what the company is doing today, they are incorporated into their environment and the rules of crime can be associated with these demonstrations [11].]. Issues such as, Intent: explicit or general, random confirmations, expert declarations, etc., may be clearly present to show the exposures or prohibitions made by the company in carrying out its activities [12]. The main shock is how the world is segregated from the implications of these manifestations [13]. There are different philosophies from different countries around the world to reveal and interpret a company's exhibitions and identify the goal behind it. The countries of customary law and law based on perspectives; All have distinctive means of coping with the criminal purpose of an institution. In any case, the hidden choice here is that the illegal reason and misconduct of the association for any condition is neglected.

Nature of Corporate Criminality

The control stretches out just to those cases when a representative or administrator acted, or acquired learning, inside the degree of his or her business, searching for, at any rate to some degree, to benefit the enterprise [14]. The law is to some degree unverifiable when a dog not upon the data or the intent of a solitary specialist yet upon joined activities or learning of a couple of others who have followed up on in an agreeable idea. As indicated by one view it is said that "An aggregate data rule is fitting with regards to corporate criminal liability [15]. The demonstrations of an organization are, everything considered, basically the demonstrations of most of its representatives working inside the degree of their business. The corporate criminal liability law reflects this.

Theories Of The Corporate Crime Liability

That is rules of standard criminal conditions to wipe out the record and to involve the crime of a man. Despite the path that in the meantime, an affiliation in general is said to be a non-figurative and imaginative social segment that is not equipped for physical movement or any information, or that should work randomly. So far, Commonwealth districts have regularly approached this weight through an obvious point of view, that is, seeing the report as a minor social opportunity for the people and finding their criminal responsibility for approving the guilt of your players in the world. company [16].

Vicarious Liability

Western countries have seen the region and the impact of the corporate invasion and the criminal responsibility that resulted from it. The courts of England were the pioneers to work this way. Through his laws of causes he obtained and strengthened the hypothesis of indirect responsibility or what the American resolution later called for the unrivaled Respondent theory. Britain was the bearer of light to work to the point that affiliations are at risk for shows performed by the experts and supervisors of that affiliation.

Rationale of Vicarious Liability

The courts have given several reasons to legitimize the responsibility of an association for this administrator's shows. All things considered, the most all-around saw procedure for believing is hardship transport [17]. This safeguard suggests the torments encouraged by an association's specialists are to be composed upon to connect itself as it sufficiently fits that should be cooperation that should bear the disaster and not the incident or right blue party. The hardship should go to a relative pocket, and which was on edge to take the preferred advantage [18]. In like manner, the association is better planned to hold the difficulties as an expense of sorting out since it could be revolving around the tries to society through broadened charges for its things or by getting security. Meanwhile, and under the current law another aid for indirect responsibility has begun which in addition to establishing the impact on the company's leadership in a certain way[19].

Criticism

The vicarious liability manage is decried for hurting issue, particularly in relationship with mensrea offenses, and since this blame of an individual is immediately exchanged to the association without the confirmation of the last's misfeasance. An association's endeavors to envision unlawful development by agents might be disregarded in the utilization of the vicarious liability standard [20].

The principals improved the situation him by a general head which is unusual to or as a general rule a touch of exchange which the specialist has been affirmed to perform. Similarly, this is the condition, which does not respect the way in which the reality is configured that the indication has been altered by the key, even if the headings that have involved the individual have remained the master of higher dispositions almost in their all those responsible for crossing attempts and their crimes in this effort have influenced the relationship to expose by paying little attention to the probability of neglecting.

The corporate bodies, for instance, a firm or organization endeavor game plan of exercises that impact the life, freedom, and property of the subjects. Tremendous scale cash related abnormalities are finished by various organizations. The company vehicle currently includes a colossal front-line fragment, business and sociological parts that the sensitivity of the association to a criminal law is essential to have a quiet society with the stable. Absent the possibility of the criminal obligation, organizations would escape moral conviction for a crime, and the retributive import of criminal risk to the group would be lost. For under a common risk administration for the organization qua enterprise, there would be no moral judgment proportional to a criminal conviction:

IX. CORPORATE CRIMINAL LIABILITY AND INTERNATIONAL LAW

The possibility of corporate constrained hazard may be taken and saw as honorably another when showed up diversely in connection to the present standard laws. The role of multinational organizations in our well-ordered lives has acquired a radically new meaning. Directly or indirectly, we have changed the associates of these anxieties. The evil caused by the exercises of these substances can have gigantic effects. The substances at show are providers of stock and adventures just as rather, they are the new gadgets of by and large progression moreover. Quantum of understand that they can verify from their interstate exercises is now and again mind blowing. Furthermore, different multiple times there isn't clowning impact on the general cash related structure.

The essential responsibility for the screens of an association has been seen for a long time and several nations that have genuine general systems improve the weight of the companies' criminal commitment. Countries like; Bulgaria, the Slovak Republic and Luxembourg do not perceive the congruence or the presence of criminal commitment standards for the evil committed by an association. Countries like Brazil are new, changing their positions from refusal to certification. Although countries like Hungary, Germany, Greece, Sweden and Mexico do not

help the possibility of a corporate criminal commitment, they have regulatory controls and administrative plans to address the violation of the law by a corporate movement.

Corporate Crimes in India

John Braithwaite, an Australian criminologist, depicted corporate crime as "the lead of an endeavor or delegates following up for an association, which is cleared and defending law. Corporate lead has been constrained by the corporate laws since long [21]. It's credibility that the responsibility of an association for criminal wrongs is tended to. The standard laws influence an association to subject for the activities of its specialists when experts/administrators act inside the dimension of their business and make inclination for the meander with that appearing.

The hypotheses set forward that the corporate criminals are offenses executed by corporate experts for their association. The offenses are given for corporate get or to pass on dishonesty to some other corporate. Like any individual, an association is completely organized finishing various criminal showings like, settling a national or general open ace or government to accomplish business, dumps deadly present-day squander into streams or debase the underground water assets, perceive unlawful cost avoidance, human or medication dealing, cash related fakes and so on. Corporate infringement are once in a while peaceful acts in light of the course that in most extraordinary cases people don't realize whom to fault and are for no circumstance careful about the manner in which that they have been boggled until the point that the minute that a huge deviousness has been done to them, their families or their enduring condition[22].The cutting edge Corporate has changed into a goliath who is appropriating from the purchaser alone and additionally from the general masses all finished and that too without a glitch[23].

White-collar Crime in India

White collar criminality has changed into a general contemplate with the advancement of exchange and headway. Like some other country, India is moreover in the hold of white-collar criminality. The explanation behind the huge development in white collar crime in late decades is to be found in the fiery making economy and mechanical difference in this creation country. The Santhanam Committee Report in its finding gave a striking picture of white-collar crimes Committed by individuals of decency, for instance, businessmen industrialists, brief workers and providers as furthermore the exacerbate open specialists featuring the level of white-collar crime in India. The commission on reprisal of Corruption in its report saw:

Corruption

Corruption is one of the most noticeably bad type of crimes in India. It has been into reality for a long time. Indeed, even Chanakya has specified the different types of corruption amid his chance. Numerous political gatherings have guaranteed to annihilate corruption, be that as it may, the guilty parties in these kinds of crimes are typically the administration authorities or the government officials itself. In the middle of 2010 to 2012 Central Bureau of Investigation has

enrolled more than 1,450 instances of charged corruption under the Prevention of Corruption Act, 1988. The diagram articulated in this underneath demonstrates India's rank among the other 175 nations regarding corruption from 2012 to 2016.

In India Crime and Fraud in White Collar

Extortion keeps being a significant issueworldwide and all the more so in India. Of theorganizations inspected, far reaching 75% revealedencountering extortion amidst the year. Despite theway that the figure has diminished strikingly withbefore year's 88%, the circumstance is so farshocking. In India, the circumstance is awful, with 84% affiliations revealing that they encountered extortion amidst the year. It is refresh for India, as it is arranged second worldwide after Africa and offers the situation with China The diagram underneath looks guideline six extortion orders at general level with India. In a tremendous section of the cases, India is doing fundamentally more appalling than its general associates are. General organization past compromise condition, inner cash related extortion, contamination and compensation and dealer acquiring related fakes have broadened. Physical theft of central focuses and information burglary diminished. Indian business crucial torment focuses are debasement and pay off, information theft, inside cash related extortion, budgetary misuse and trader securing.

X. CONCLUSION

Therefore, in the case of the "previous examination", it seems that there is still no established guideline on the criminal liability of companies. It is a completely new legal region in which the legal executive and the governing body must work. In 2002, Donald Rumsfeld had spoken of "known knowledge", however, in a very surprising environment. Along these lines, we can dare to dream that an official choice on the benefits diminishes the different issues to the "known knowns" and get the disrupted question dealt with on this setting of law. It is likewise to be seen that the current and potential financial specialists' misfortunes their certainty and trust in the association". This corporate criminal liability has an undulating impact on the economy of the country too.

India enrich with for Corporate Criminal Liability in wide terms. As noted, before, after the ongoing decision of the Supreme Court in Standard Chartered, organizations in India can be indicted for pretty much every punitive offense that exists in any Indian resolution. The Companies Act likewise accommodated criminal liability of organizations just as its executives under a large group of various conditions. Huge activities are required to change basic shortcomings, without which, corporate administration practices will keep on staying weak, which would thus, render the open reluctant to make interests in corporate houses.

Consequently, the rise of the huge mechanical corporations, both depersonalized and regulated has a noteworthy social wonder and its effect on the lawful, monetary and social structure of the general public must be viewed so as to settle the issue of criminal liability that are been completed by the corporations in the present society.

As recommended by the current writing, joint liability of the involved corporate officers, just as the corporation itself, would be best as far as prevention and reprisal. While singular officer liability is an imperative beginning stage towards corporate criminal responsibility, it would not represent the hierarchical component of corporate bad behavior. However, the corporate setting in which crimes are carried out issues, as future maltreatment must be avoided if punishments are forced at the corporate level, not simply the individual level. This is especially evident when managing corporate association in substantial scale barbarities, which would typically be endemic of a fundamental hierarchical structure and corporate culture that lead to the infringement in any case.

The corporate criminal liability models so far demonstrate that the best way to viably rebuff and fight corporate crime is to criminally rebuff corporations. Indictments of people just is out of line not exclusively to them," yet to society everywhere in light of the fact that feelings of people will once in a while influence the manner in which corporations will direct their business later on. Additionally, "civil and administrative liability of corporations is not sufficient. Victims do not always have the finical resources to pursue a civil action. Criminal law punishes justly; its irreplaceable retributive, deterrent, and rehabilitative characteristics satisfy the public demand of vengeance." Criminal punishment of corporations sends a representative message: no crime goes unpunished and crime never pays.

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SOCIAL MEDIA ADVERTISING: A PLATFORM IN NEW ERA

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ABSTRACT

Social media is the platform where customers communicate directly to brand and their representative. However, the important is: who the group of people is available online and how it affects their demand. This paper aims to answer this question based on a study regarding the online activities of 50 social media users, by identifying types of users, to examine how different forecasters related to social networking sites have a positive impact on the respondents' perception of social media advertisements. The research can help and discover how to engage with different types of customers for the effect of the social marketing strategy.

Keywords: Social media marketing, social advertising, online marketing, new marketing eras.

INTRODUCTION

Since last 20 years, we have experienced a major swing in business control and people interaction. The introduct

ion of Mobile phones, the Internet, and e-commerce have consumed a wonderful impact on businesses operation activities and marketing activities. The growth of social media technology is fast-tracking and we can presume that it affects businesses now and into the future. Businesses that hit new technologies gain more and more benefits. Technology-driven companies such as Microsoft, Amazon and Google grew more and more. In a short duration, social media become the most loved medium for the Indian youths today. Social Media Advertising is the new advertising concept and every entrepreneur wants to know how social media can generate value for their business. People like in Indian market are social by nature and collect or share information that is important to them. Social Media helps in making easier for people to connect socially with their social networks and as a result business can gain profit from that understanding. More and more of your customers, whether for personal use, business-to-consumer or business-to-business reasons use social media in every aspect of their daily life.

Social connectivity includes social media and social networking sites (SNS).Social media are tools for sharing and discussing information. It can be described as a kind of online media which encourages every member for feedback and contribution. Social media can be described as a broad term inclusive of activities where people create content, share it, bookmark it and network at a phenomenal rate. On the other hand social networking site is a platform where in one forms

communities of interest to connect to others. Social networking sites utilize social media technology to connect with people and build relationships.

Role of social media in marketing:

- Social media in recent trend become an aspect of political campaigning, national strategies, public policy, public relations, brand management and even intra company communiqué. In the new era, the marketing tool used to inform consumers about the company's products, who they are and what they offer, social media plays an imperative role in marketing.
- Social media is helpful in providing an identity about the companies and the products or services which they will offer.
- Social media is helpful in creating relationships with people who are unaware about the products or service, what the companies represent.
- Social media helps to associate themselves with their peers that may be serving the same target market.
- Social media also used to communicate and interact with consumers look for.

SOCIAL MEDIA OUTLETS/PLATFORMS TWITTER, FACEBOOK, GOOGLE+, YOUTUBE, BLOGS

Social networking helps individuals to interact with one another and developed relationship. When any corporate join this platform, people can interact with the product or company. That interaction feels personal to social media users because of their direct interactions with product and company. Social networking sites allow individual followers to respond comments made by the product being promoted. By responding, all of the user connections are able to see the message, therefore reach up to more and more people. Social networking sites now a days, act as word of mouth. Because the information is being snuff out there and is getting reply, more response is brought to the product/company. Through social media, products/companies exchange their ideas and interact with customers. This personal interaction can lodge a feeling of loyalty into customers and potential customers.

2014 PARLIAMENT ELECTION: The 2014 campaign for general election had a massive presence on social networking sites in the developing country India. Narender Modi, a candidate for Indian Prime Minister, used Twitter and Facebook to differentiate his campaign. His social media pages were continuously updated and interacting with followers. The use of social media gave his campaign access to social mail addresses, as posted on social media profile. This creates the NDA to launch social media campaigns asking for votes and campaign donations.

SMALL SCALE BUSINESSES: Now a day, SSI's also use social networking sites as a promotional tool. Businesses can follow individuals through social networking site in the local area and advertise their products and services. These can be exclusive and in the form of "connect with us and get a free lunch". This type of message encourages following the business through social media in order to obtain the promotional deal. In the process, the business is advertised and promotes itself.

The famous tools for Social Advertising in Indian market are Twitter and Facebook.

TWITTER

Twitter also allows organizations to promote products on an individual level. The use of a product can be explained in short limited messages or video that followers are more likely to read and watch. These messages appear on followers' home page. Messages can be linked to the product's website, photos, videos, etc. This link provides chance to followers to spend more time interacting with the product and corporate online. This interaction also creates a loyal connection between product and individual and also leads to superior advertising opportunities. Twitter promotes a product in real-time and brings customers connected.

FACEBOOK

Facebook media is more famous than Twitter in Indian market. They allow an organization to provide videos, photos, and longer explanations. Videos inform when and how a product will be used. The followers can comment on the product pages for others to see. Facebook can link back to the product's Twitter page as well as send out event reminders. Facebook promotes a product in real-time and brings customers in touch.

IMPORTANCE OF SOCIAL MEDIA SERVICES

- **Size:** India has 71 million active internet users. Facebook has over 250 million users globally. An average a user on Facebook has 120 friends. This is a Social networking sites support and with this comes the license to communicate powerfully throughout the world. But when such large numbers are involved, there is a danger of something going wrong and when it does, it happens in a big way. An expert should be hired to do what is best for business.
- **Transparency:** No cheat code involved. No black hat techniques allowed. Everything that happens in the social networking landscape is fool proof. Opinions made on social networking platforms are taken seriously and the more authoritative the companies get, more seriously they are taken.
- **Reach:** It is possible to make mark globally and do it quickly using social networking sites.
- **Boost website traffic:** Social media is probably the fastest and easiest means of redirecting traffic to company's website. By simply assigning their website URL in their profile, the company can have all their profile visitors check out their website and a percentage of traffic is sure to get converted in course of time. This is the effective way of "word-of mouth"

ADVANCED SOCIAL MEDIA MARKETING STRATEGIES FOR SMALL BUSINESSES

An advanced social strategy is a technique that works beyond the normal social media presence. It introduces a marketing message while approaching a user to another profile or business site. In a recent advanced strategy, it's important that a business would understand social marketing, has experience engaging consumers, and to possess a basic understanding of online marketing.

Strategy 1: Multimedia Usage

The term "A picture is worth a thousand words" has never been truer. Consumers are now using the electronic web to look for product pictures and videos; they want more information about what they're considering buying. It's not difficult for a company to create and publish videos and pictures.

In addition to taking photos of products, a company can also publish pictures at office events as a way to highlight company culture. This not only helps prove to others to work with you or to buy from you. It also helps HR department recruit new employees.

Videos are useful for explaining complex concepts. Showing step by step directions can have a greater impact than even the most well written article for the use of a product.

Example: WorldMusicSupply.com

WorldMusicSupply.com, an online retailer of musical instruments and accessories, has used YouTube to build a strong online community. Their channel has built over 17,000 subscribers and has over 600,000 views.

Strategy 2: Integrate Offline and Online Advertising

Many small businesses work for offline advertising, whether it will be radio, print, or cable. Social marketing also allows a business to extend their offline sales pitch.

Including organization's Facebook Page or blog URL in offline ads act as social proof, inviting potential consumers to see community and increase trust in business. Not only can integrating online and offline advertising help the conversion process, but it can also help in building community. Introducing potential consumers to organizational social profiles means they may join organizational community now and buy later.
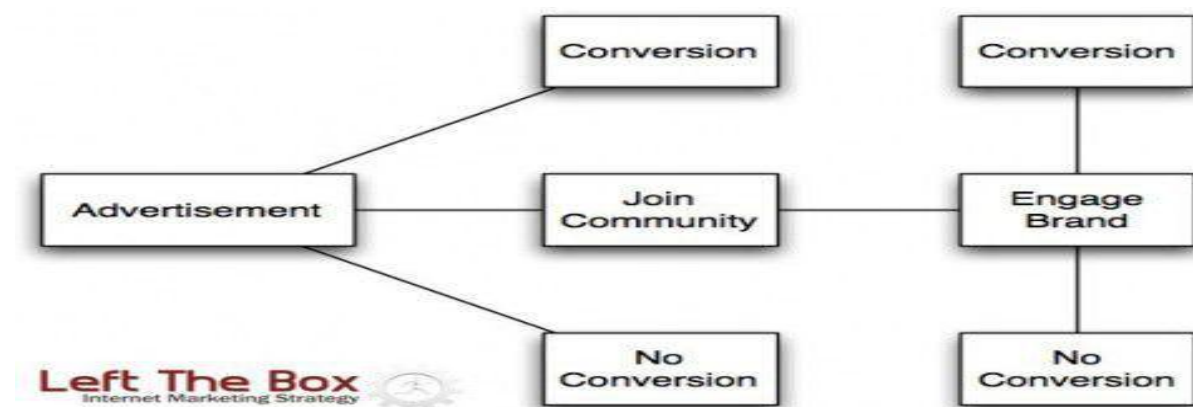
Strategy 3: Message Adaptation

Now a day a business start will become more sophisticated. But with social media it's leverage because of providing more online platforms. However, most deliver the same message over multiple platforms instead of tailoring communications for each individual site.

Social media have an ecosystem and plate form of their own. What might be acceptable on Tumbler might be considered spam on Facebook. A specific style of writing might extend on Twitter but fail on Friend Feed. Understanding that each social site is different and then customizing message ensures they do well on each respective site.

Not only does customizing messages across sites help the message spread but it keeps users from receiving multiple identical communications. Be sure to maximize your potential by sending a user that follows the business on Twitter and Facebook two different messages, instead of the same thing.

Strategy 4: Local Social Networks, Beyond Yelp

For a small business, local search can create a big win. Being visible to consumers looking for a business in their area is really important. Make sure site is included in local business directories in order to help ensure that consumers find when they need. Sometime found that many sites can be difficult to find and user.

First, may check competitors. Where are they listed? Check their inbound links to check for business directories and can add yourself to. Also, make sure that business has been added to Google Maps, using the Local Business Center.

Take the time to include all the information company can and update old news. For many consumers, this will be their first interaction with the company.

Strategy 5: Contests and Discounts

To create a community is the first stage of social marketing. To drive sales, propagate marketing, or crowd source operations is the true power of social media. To promote the community is collectively do something to create a contest or offer an exclusive.

A good social media include some sort of sharing or viral as a requirement for winning.

Discounts are also a great way to connect with company's community. By giving exclusive coupons to social community, you're rewarding and reminding them that you are not a brand to engage with, but also to buy from.

CONCLUSION

In the recent era, Social platforms have a network of their own. To create a basic social media presence is easy enough; getting business community to actually do something is more difficult. Business should confirm that their site is included in local business directories in order to help ensure that consumers find them when they need business.

Whether an individual, an entrepreneur, small business or a large corporation, an online presence and an ongoing conversation with constituent is an initial requirement – and will take time and expertise.

Companies must focus on their own resources and re-evaluate their traditional outreach strategies. And as the social media trend, dissolve into the ocean of connected experiences. The term itself will become an entry in dictionaries and guides and would be an embark on a new era of knowledge, accessibility and experiences unbound by distance, time or physical walls. According to the findings of this research, it is a time in which every business should adopts social media to connect customers.

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SMART EDUCATION ARCHITECTURE USING THE INTERNET OF THINGS (IOT) TECHNOLOGY

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ABSTRACT

Smart Education is now a typical feature in education emerging from Information Communications Technologies and the constant introduction of new technologies into institutional learning. The aim of the Smart Classroom is that users develop skills, adapt and use technologies in a learning context that produces elevated learning outcomes. Technologies, such as cloud computing, learning analytics, big data, Internet of things (IoT), wearable technology etc., promote the emergence of Smart Education. The IoT is a new paradigm in which objects equipped with sensors, actuators, and processors communicate with each other to serve a meaningful purpose. IoT influences education in many ways that enable institutions to make decisions that are more informed in an effort to improve student learning experiences, operational efficiency and campus security and many more. The purpose of this article is to look at the IoT requirements and devise a model and architecture required for Smart Education, which leads to big data.

Keywords: e-Learning, Internet of Things, IoT architecture. IoT model, smart classroom, smart education, smart learning, smart teaching,

Introduction

Technology has recently changed the educational landscape. The increase in human knowledge and steady technology advances higher educational institutions (HEI) make the best use of the resources available and keep learning up-to-date. In an age determined to generate new paths to quality education, Information and Communications Technology (ICT) brings forward countless benefits. ICT makes many ordinary tasks uncomplicated and facilitates communications from virtually any part of the globe. ICT in education has been linked with an upward shift in the quality of people's lives by improving teaching and learning.

The use of ICT techniques in learning/teaching has a very positive influence on a student's learning capabilities as well. It is established that students reflect in a very positive manner towards work and education when they are using computers to complete tasks given to them, encouraging and motivating them to soak in the knowledge. Students who used technology to learn in educational institutions have increased self-esteem and self-confidence. This is why a number of educational institutions are increasingly integrating ICT in their education system. With the advent of technologies, HEIs can now keep track of resources, create smarter lesson plans, design safer campuses and improve access to information. From the use of mobiles and tablets in the classroom, education looks very different today.

Technologies and Education

Electronic learningor e-Learning is the use of ICT to enable learners to learn from anywhere and anytime. The delivery involves the use of electronic devices such as a smartphone and tablets in some way to make available learning contents. It makes the learning process more efficient for learners as well as teachers. By now, an e-Learning has been limited to virtual classrooms, video lectures and animations, online tutorials and study materials. In the age of information technology, developing with modern technology means to grow and achieve the benefits of the birth of new technology. Cloud computing, big data computing, Internet of Technology(IoT), etc. are some of the recent technologies, which have been introduced recently for the infrastructure level(s) of e-learning systems in the world of information technology.

The IoT and big data technology change everything including e-Learning platforms. It is important to identify a sophisticated strategy to combine different types of data in a way that they provide the best result to the learner, the user of the e-learning platform. In this context, big data learning integrates the mix of structured and unstructured data in one data repository to facilitate access in addition to an optimal relevance of search with adequate and consistent results according to the expectations of the learner. The big data learning system performs the capture of all types of data (text, image, video, audio, etc.) related to the subject of the theme and groups them in its raw data repository. It then includes data of any type, such as posts, pictures, videos, audio tracks, etc. IoT is a technology that capture data from the IoT enabled devices installed in the learning environment.

The introduction of the IoT in e-Learning can really help to transform education. The huge data created by the IoT is measured for high commercial value, and data mining algorithms can be applied to IoT to extract hidden information from data. It enables the collection, exchange, and analysis of generating information. The IoT has the potential to affect every aspect of learning processes. IoT continues to revolutionize e-Learning and is expected to bring in more 'connectedness' and smart classrooms in the future.They take the advantages of new capabilities by developing pedagogical approaches that leverage the technologies emerging in the environments around us (Watson, *et al.*, 2013).

Most e-Learning platform delivers video tutorials using smart devices. Video content is easily integrated into small IoT-enabled devices and can be more effective than the text content. This includes learning applications, which require managing huge and mixed volumes of information coming from IoT devices. HEIs have to adapt their technologies to be able to handle the large amounts of learning content generated by IoT devices. Once data has been received then it is to find big data technology platform for storing IoT data. The devices that will make up the IoT, as well as the kinds of data they generate, will vary by nature.

Motivation

The present education system has changed drastically in the past few years and will continue to transform. Technology is rapidly being used as a tool to deliver new and better ways of engagement among students and teachers. Digital books, MOOCs, personalized and Mobile learning are nowadays making waves, The future of technology in the education industry will

broadly be influenced by virtual reality, wearables, location-based services and sensor technologies. The motivation behind to propose this work is shown in Fig. 1.
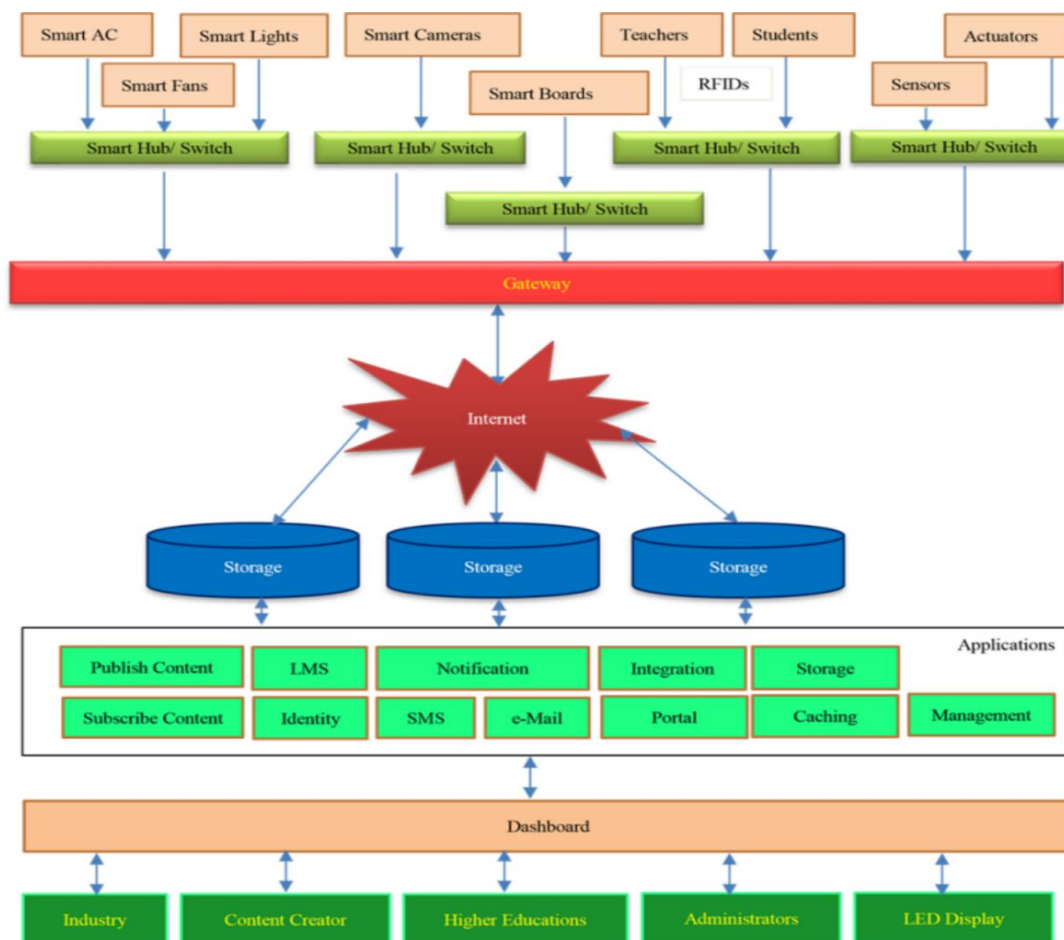
Fig.1. A scenario of smart education

Traditional classrooms using blackboard, projector connected with the desktop system do not record their activity in any form. However, it can do the recording of teaching and learning activity can be collected through any enhanced devices. These recorded classroom activities help in many ways to all learners, even those who do not know those subjects, topics whereas teaching using IoT and mobile devices reaches out any corner of the world.

Issues and Challenges

There are a number of challenges and issues for utilizing ICT technology in an e-Learning environment. Some of the challenges and issues are given below:

    i.   Integration of physical objects with smart learning objects and activities

ii. Design of scalable architecture that supports reliable devices for the smart learning environment

iii. Design of huge amount of storing and analyses of learning data

There is a big need to design a generic model and architecture in the e-learning industry to overcome the above challenges and issues. This generic model and architecture aim to facilitate scalability, interoperability, simplify development, and ease implementation.Thus, IoT is needed to support big data e-Learning and overcome these challenges.

IoT in Education

Introducing the big data and IoT with an ordinary classroom can be transformed into a smart education. In order for students to be prepared for a more complex learning environment, a smart classroom must promote creativity, critical thinking, communication, and collaboration. Technology tools that allow students to create with audio, text, and images provide an opportunity to build higher-order thinking skills. They enable e-Learning professionals to customize the e-Learning experience to provide learners with more informative, engaging, and engaging e-Learning courses. They actively listen and analyzes voices, conversations, movements, behaviour, etc., in order to reach a conclusion about the teachers' presentation and learners' satisfaction. This enables teachers to consistently deliver better presentations and make a better impact, while the audience benefits from interesting learning contents.The IoT in e-Learning bring incredible challenges such as standards, reusability, interoperability, adaptation, etc. and opportunities to educational institutions.

The introduction of the Internet of Things (IoT) in education, which allows Internet-based communications, has changed higher educational institutions massively. IoT provides a more engaging learning environment for students and more data about the learning process to help teachers to enhance their knowledge about the learning pace of their students and their learning difficulties.

Higher education institutions begin to leverage solutions across an IoT platform, they are able to capture, manage and analyze big data (Palanivel K & Chithralekha T, 2017). The IoT does a collection of data from the smart classroom and store as big data for future use. For example, the IoT education system uses sensor-enabled devices mounted in classroom doorways and they attached to teachers and students identity card holders. The sensor-enabled devices tag to be teachers and student's identity cards and the sensor reader installed near the entrance of classrooms. Because all teachers and students would arrive at institutions at the same time in the morning and everyone needs to read their student card, then everyone must spend few minutes' complete attendances every day. Many educational institutions use sensor devices tags as the teachers and student's identity card and may be integrated with many functions into the card such as security, library, motorcycle parking, payment, etc. The conceptual working model by sensor devices or IoT devices to confirm all teachers and students attendance and total attendance number in this classroom.

Theabove-collecteddata can be uploaded in the required format, then and thereby using a learning management system (LMS). This application synchronizes those things timely duration

to reach outsiders of the classroom. Therefore,learnerscan learn those lessons even being outside that classroom.This insight provides stakeholders with a real-time view of learners, staff and assets. It enables HEIs to make decisions that are more informed in an effort to improve student learning experiences, operational efficiency and campus security.

Proposed System

This article focuses on introducing the IoT in higher education, in order to demonstrate the new way of interaction among students and teachers and the movements produced in a smart academic environment. It is proposed to devise a generic IoT architecture to smart education that addresses the above challenges and issues presented above section. The IoT architecture will provide maximum reusability, interoperability, scalability, etc. Some of the common characteristics that the proposed IoT architecture should embrace including loosely coupled, modular, platform independent and based on open standards. The proposed architecture handles the requirements and forms a superset of functionalities, information structures, and mechanisms. The architecture must also be flexible so that it can be modified to change according to future needs. Aqualitativesurvey was taken on the proposed IoT reference architecture solution, validating usability and acceptability of the referenced system among stakeholders in a tertiary educational environment.

Section 2 describes the background details that required forwriting this article. Section 3 reviews various research papers on IoT architectures on e-Learning domain. Section 4 describes the proposal that consists of requirements, IoT smart education model and IoT architectures to e-Learning domain. Finally, section 5 concludes and outline future works.

Background

This section presents the background details that required forwriting this article. This includes smart education, Internet of Things and software architecture.

The Evolution of Technologies in Education

Today, technology can be as media or tools for accessing learning content, inquiry, communication and collaboration and evaluation of teaching and learning. The technology can be implemented and utilized in helping learners learn. This is described as technology-enhanced learning (TEL). TEL is used to provide flexibility in the mode of learning. Technologies, such as mobile computing, seamless learning, cloud computing, learning analytics, big data, Internet of things (IoT), wearable technology and etc., promote the emergence of smart education (Zhu, ZT. Yu, MH. & Riezebos, P. 2016).

With the development of the above technologies, learning has become a major TEL paradigm. Using mobile learning, ubiquitous learning (Hwang, 2008) and seamless learning, the learners can learn across time and locations, and they can convert the learning from one scenario to another conveniently encompassing formal and informal learning, individual and social learning through the smart personal device (Chan, T.W. Roschelle, J. His, S. et al. 2006). Technologies like cloud computing, learning analytics and big data focus on how learning data can be captured, analyzed and directed towards improving learning and teaching, support the

development of the personalized and adaptive learning (Schönberger, M.V. & Cukier, K. (2013). With these adaptive learning technologies, learning platform reacts to individual learner data and adapts instructional resource (NMC, 2015). Wearable technology can integrate the location information, exercise log, social media interaction and visual reality tools into the learning.

As a new educational paradigm, smart learning bases its foundations on smart devices and technologies. For educational technology, 'smart' refers to accomplish its purpose effectively and efficiently (Spector J.M. 2014). The technology includes hardware and software. For hardware, 'smart' refers to the smart device much smaller, more portable and affordable. It is effective to support learner take place the learning anytime and anywhere with smart devices (e.g., smartphones, laptop, Google glass, etc.). For software, 'smart' refers to adaptive and flexible. It is efficient to carry out personalized learning for learner according to their personal difference, with adaptive learning technologies (e.g. Cloud computing, big data, learning analytics, Internet of Things, adaptive engine, etc.).

Smart Education

Smart education, a concept that describes learning in the digital age, has gained increased attention. It enables leading-edge technologies into educational institutions. The goal is to foster engaging learning experience to meet the diverse needs of learners, through the innovative use of information and communications technology (Education, 2007). Zhu, ZT. Yu, MH. & Riezebos, P. (2016) stated that "the essence of smart education is to create intelligent environments by using smart technologies, so that smart pedagogies can be facilitated as to provide personalized learning services and empower learners, and thus talents of wisdom who have a better value orientation, higher thinking quality, and stronger conduct ability could be fostered". The smart education proposed the keys for achieving - embracing and expanding online learning, utilizing transformative technologies, high-speed network connectivity, extending connectivity to the classroom, providing high quality and continuous professional development (Smart, 2014).

Tikhomirov, V. Dneprovskaya, N. & Yankovskaya, E. (2015) stressed that nowadays progress of e-Learning that contribute to the formation of a new educational trend called smart education. This trend provided outstanding opportunities to acquire different professional skills, competencies and knowledge through active use ICT. Zhu, ZT. Yu, MH. & Riezebos, P. (2016) said that the goal of smart education. Intelligent technology plays an important role in the construction of smart educational environments. The smart educational framework is to describe the essential elements in a technology-facilitated environment that on the one hand helps learners to achieve higher thinking quality and leads to innovation and creativity and on the other hand enables teachers to personalize learning. The three essential elements in a smart education environment are taught, technology, and learner. Fig.2. shows the proposed framework for smart education.
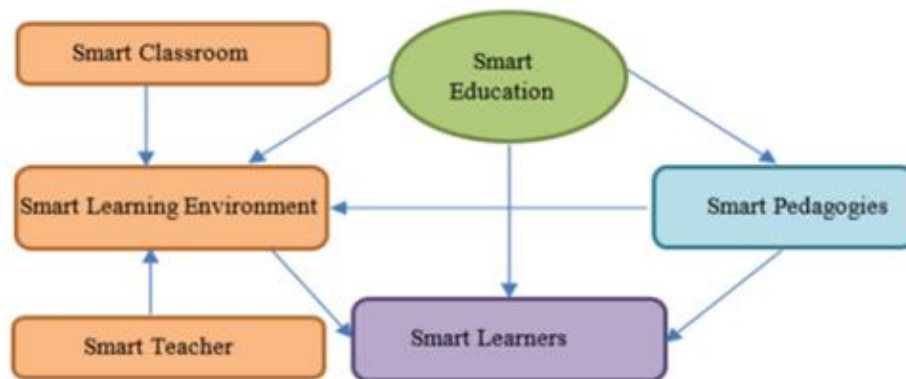
Fig.2. A framework of smart education.

This framework describes the essential elements in smart education: *smart environments*, *smart pedagogy*, and *smart learner*. Smart education emphasizes the ideology for pursuing a better education and thus had better be renamed as smarter education, which addresses the needs for smart pedagogies as a methodological issue and smart learning environments as a technological issue, and advances the educational goals to cultivate smart learners as results. Smart environments could be significantly influenced by smart pedagogy. Smart pedagogies and smart environments support the development of smart learners.

Smart Classroom

The smart classroom strategy is a learning initiative that assists educators to make ICT integral to learning as part of the education. A smart classroom is a transformative strategy to transition from traditional ways of working to a digital way of working that is meaningful, engaging and connected (Uskov, V. Howlett, R& Jain, L. 2015). Learner activities should be connected to both the content of the respective subject and the real world, however, the future classrooms (Kankaanranta, M.& Mäkelä, T. 2014) should not become a high-tech entertainment park. The smart classroom will be characterized as a classroom with IoT solutions that provide learning analytics solutions, learner-centred teaching, the digital revolution and related paradigm shift in education towards more personalized, collaborative and creative learning.

Smart Classroom (Shi, 2010) aims to build a real- time interactive classroom with tele- education experience by bringing pervasive computing technologies into traditional distance learning. The goal of the smart classroomis to narrow the gap between the teacher's experience in tele- education and that in the traditional classroom educating, by means of integrating these two currently separated education environments together.

The smart classrooms' strategy for e-Learning is comprised of interrelated and co-dependent components (Byte, 2016) and they are digital or smart pedagogy, digital content and e-Learning spaces. These components co-exist to create the conditions for a new generation of digital learners. If one component is missing, the approach is unbalanced and less effective. For successful integration of devices in a classroom environment, an education provider may have to face many difficulties (Gul, S. et al. 2017).

Smart classroom enables learners to digital resources and interact with the learning systems in any place and at any time, but also actively provides them with the necessary learning guidance, supportive tools or learning suggestions in the right place, at the right time, and in the right form.

Smart Teaching

Smart teaching largely involves the organization of teaching and learning activities with the help of software tools. In broader terms, smart teaching is a way of professionalizing the teaching and learning experience. Smart teaching can have classrooms with technology that goes beyond a set of teacher-centric tools and allows students to use the power of the internet to take part.

Smart teaching is considered very controversial. It is described as a bunch of different teaching methods and strategies for teaching and from the other side how to use smart technology in the classroom. Smart teaching addresses the above issues common in traditional teaching in a number of ways.

Smart Learning

Smart learning is a broad term for education in today's digital age. Smart learning (s-learning) means a new learning paradigm that serves learners to have an effective learning environment that offers personalized mobile contents and easily adapting to the current education model. In addition,it allows learners to have a convenient communication environment and rich resources (Kim, S. Song, S. M.& Yoon, Y I. 2011). The concept of smart learning is (i) focuses on learners and content more than on devices, and (ii) it is effective, intelligent, tailored learning based on advanced IT infrastructure.

Smart learning plays an important role in the creation of an effective learning environment that offers personalized content and easy adaptation to the current educational model.   The characteristics (Yang, S.J.H., Okamoto, T.& Tseng S.S. (2008) of context- aware and ubiquitous learning and the detailed descriptions of these aspects are shown in Table -1.

Table – 1. Aspects of smart learning

S.No.	Aspect	Description
1	Adaptability	The adjustability of learning contents and services
2	Interoperability	The interoperable operation between different standards of learning resources, services, and platforms.
3	Location awareness	The identification of learners' locations.
4	Mobility	The continuousness of computing while learners move from one place to another.
5	Pervasiveness	A transparent way of accessing learning materials and services and predicting
6	Seamlessness	The provision of everlasting service sessions
7	Situation awareness	The detection of learners' various situated scenarios
8	Social awareness	The awareness of learners' social relationship

Smart learning combines the advantages of social learning and ubiquitous learning. The potential of ubiquitous learning results from the enhanced possibilities of accessing learning content and computer- supported collaborative learning environments at the right time, at the right place, and in the right form.

IoT in Education

The IoT solutions have started to reach into the education sector, as it is very conservative. The growth of the IoT has been a positive influence on education, and how technology is being used is slowly changing, from static applications to interactive classrooms. IoT in special education is only one example of many possibilities where the IoT has been utilized in the form of teaching aid. The possibilities of use of IoT in e-Learning are numerous (Charmonman, S. et al. 2015) as shown in Fig.3.
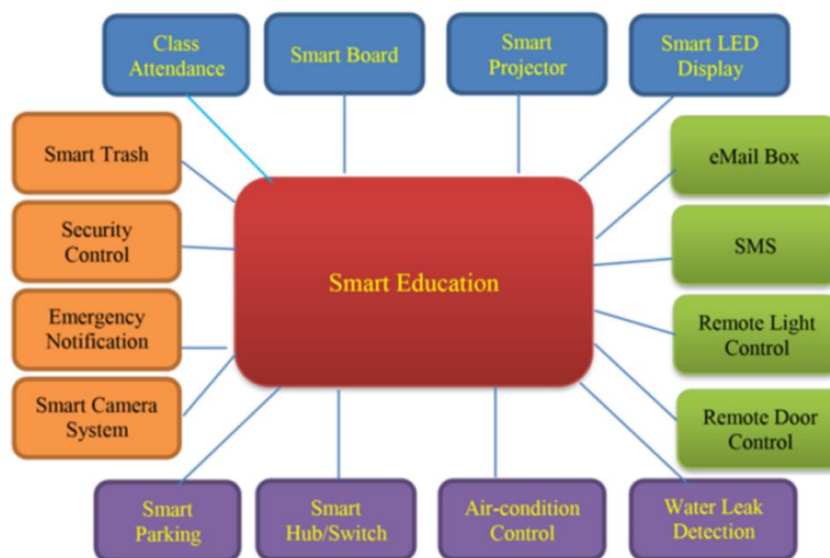
Fig.3. Use of IoT in e-Learning

IoT can be used to reduce costs, improve performance, generate new revenue streams, enhance the student experience and provide differentiated services. The applications of IoT in the higher education sector are c*ampus energy management and ecosystem monitoring*, *security campus and classroom access control*, s*tudent's health monitoring*, and i*mproving teaching and learning*. It has introduced changes in many parts of the canvas education, business model (Selinger, M. Sepulveda, A. & Buchan, J. (2013) and it can provide many benefits for educational organizations.

The term IoT in education is considered as a technological tool to enhance academic infrastructure and as a subject or course to teach fundamental concepts of Computer Science (Elyamany, H.F.& Alkhairi, A. H. 2015). It has not only changed the traditional teaching practices but has also brought changes in the infrastructure of educational institutions (Mohanapriya, M. 2016). IoT refers to the stringent connectedness between the digital and physical world (Atzori, 2010). It is defined by the ITU as:

''*A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies*'' (IoT, 2015).

The IoT system is comprised of a number of functional blocks to facilitate various utilities to the system such as sensing, identification, actuation, communication, and management. These functional blocks are a *device, communication, services, management, security and application.* Fig.4 shows the typical example of an IoT application.
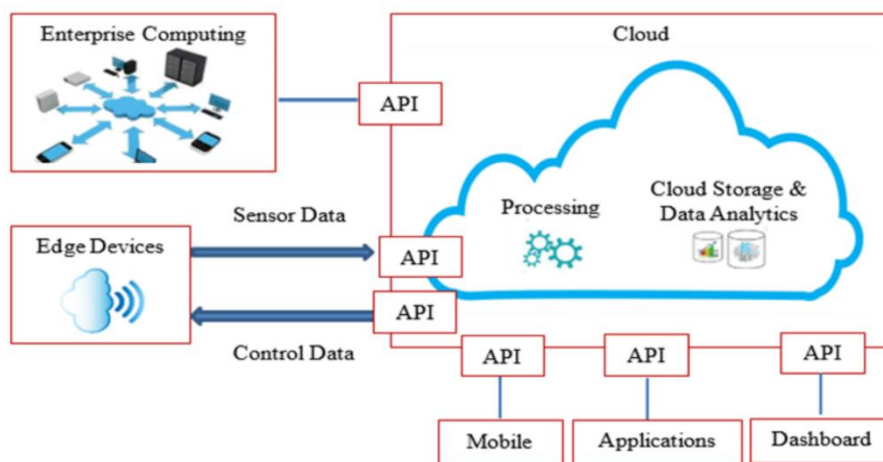
Fig.4. A typical example of an IoT application

The key features of IoT systems that represent important considerations for tomorrow's IoT (IEC, 2016) are data correlation and information retrieval, communication, integration and

interoperation, and security, privacy and trust. As IoT is a dynamic system of systems, measures to attest the trustworthiness of IoT components throughout their lifetime are required.

Various IoT technologies such as *hardware* platforms and *wireless communication* protocols are used in different applications. These communication protocols allow devices to exchange data over the network. These communication protocols form the backbone of IoT systems and enable network connectivity and coupling to applications.

IoT connectivity models

Various IoT connectivity models are device-to-device, device-to-cloud, device-to-gateway and backend data sharing. Fig. 5(a) – 5(d)shows the IoT connectivity models.

Device-to-devicemodel represents two or more devices that directly connect and communicate with one another. They can communicate over many types of networks, including IP networks or the Internet, using protocols like Bluetooth, Z-Wave, and ZigBee. This model is commonly used in home automation systems to transfer small data packets of information between devices at a relatively low data rate.

Device-to-Cloudmodel communication involves an IoT device connecting directly to an Internet cloud service like an application service provider to exchange data and control message traffic. It often uses traditional wired Ethernet or Wi-Fi connections, but can also use cellular technology.

Device-to-Gatewaymodel connects to an intermediary device to access a cloud service. This involves application software, operating on a local gateway device (like a smartphone or a "hub") that acts as an intermediary between an IoT device and a cloud service.

Back-end data-sharingmodel essentially extends the single device-to-cloud communication model so that authorized third parties can access IoT devices and sensor data. Under this model, users can export and analyze smart object data from a cloud service in combination with data from other sources, and send it to other services for aggregation and analysis.

Fig. 5(a). Device-to-device connectivity model

Fig. 5(b). Device-to-cloud connectivity model

Fig. 5(c). Device-to-gateway connectivity model

Fig. 5(d). Back-end data-sharing Model
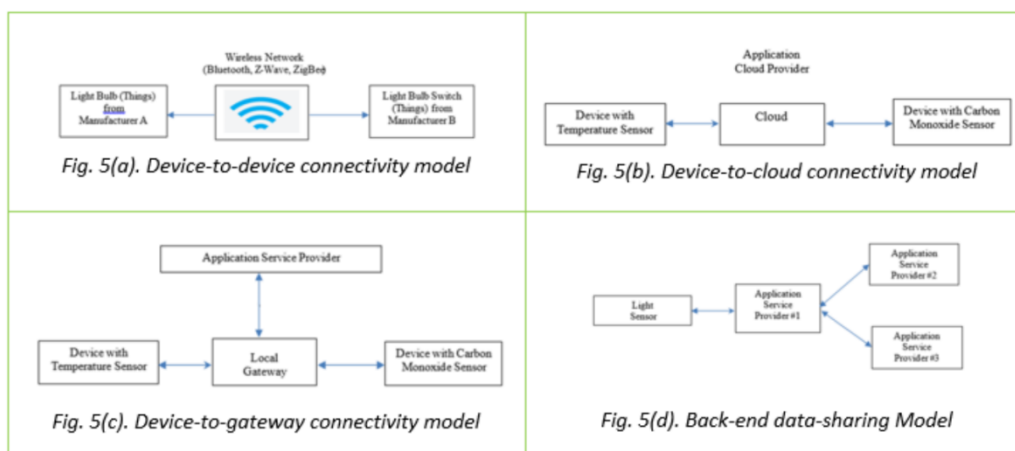
The IoT connectivity model presented above with a model for data flow, which can simply be modelled

by three stages: data creation, transmission, and consumption. This can be through simple systems that involve the user directly interacting with the device, for example, interacting with a wearable through an application on a mobile device or tablet.

Bilal, M.,2017 stated that IoT components cover a variety of the latest technologies used in the present era. Some of the major technologies are radio frequency technology (RFID), near field communication (NFC) and Bluetooth.

- The RFID is integrating a radio frequency (RF) technology via the electromagnetic spectrum to identify unique IoT devices. After all, RFID tags the devices that are readable at a certain distance in an efficient way.
- NFC is a set of the communication-based protocol used for communication between two IoT devices in the short range. In NFC, the devices must be portable for finding a suitable location. The most used applications are smartphones, parking meters, e-ticket booking etc.
- Bluetooth, a short-range communication technology designed for low consumption of power. The most commonly used applications are home automation, communication with peripherals etc. The collected data from data acquisition components will be transferred to the network.

The network is consumed and processed via different applications. The network is supported by a variety of communication-based technologies such as RFID, Wireless Fidelity (WiFi), Worldwide Interoperability for Microwave Access (WiMAX), NFC, x Digital Subscriber Line (xDSL), Bluetooth, Ethernet, Power Line Communication (PLC) and cellular-based networks.

IoT Applications

IoT is a revolutionary concept and it finds its applications in almost every field - healthcare, business, transportation, smart parking, air pollution, potable water monitoring, agriculture and management, etc. It shall find that, in all these application areas, IoT technologies have been able to significantly reduce human effort and improve the quality of life. There is a need to move from traditional education to smart education (Giovannella, C. Iosue, A. & Tancredi, A. 2012). With the IoT Platform, a broad spectrum of interoperable, cross-ecosystem IoT solutions can be built and optimized data management and analytics support (Intel, 2016). IoT systems/ applications have unique flexibility and ability to be suitable in any environment.

Design of Smart Classroom

The design of smart classroom should enable the control of audiovisual equipment's, projectors, interactive whiteboards, in order to facilitate interaction among teachers and students. In addition, it shows how the stored data are accessed through standard devices like smartphones, tablets, and laptops. The smart campus system (Amare, B. & Sengupta, J. (2017) has three parts as shown in Fig.6. The three parts are IoT hardware and software, IoT gateway and Network and Cloud. All of them combined to form an IoT-based system.
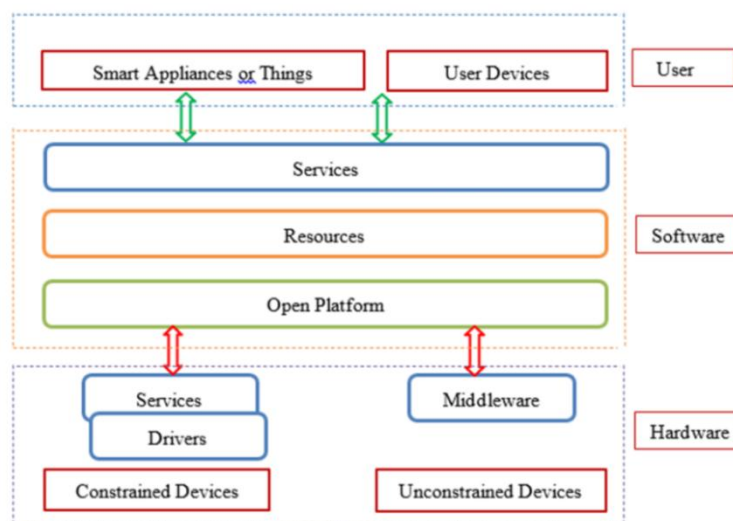
Fig.6. Design perspective smart classroom

The things or hardware and software utilized in IoT systems include devices for a remote dashboard, devices for control, servers, actuators, a routing device, actuators and sensors. The main function of the IoT hardware is like system activation, action specification, security, communication and detection to support smart education. The software addresses its key areas of networking and action through platforms. The software is responsible for data collection and device integration within the youth network. IoT Gateway controls the system. The major function of the IoT gateway is device connectivity, protocol translation, data filtering and processing, security, management and more. It is a combination of sensor data, decipher between sensors protocol, process sensors, and data before sending it onward. To collect and store data from the wireless sensor network through their IoT gateway there must a server, which is connected to the internet. On this server, a website used to access and control the sensors through the IoT gateway.

Software Architecture

Software architecture (Bass, L. Clements, P. & Kazman, R. 2003) is a flexible and hierarchical reusable architecture based on domain-specific and software product lines. IEEE Standard defined as

"Architecture is the fundamental organization of a system embodied in its components, their relationships to each other and to the environment and the principles guiding its design and evolution" (IEEE, 2000).

It isalso defined as the

"Software architecture of a system is the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both" (Bass, L. Clements, P. & Kazman, R. 2012).

The above definitions describe an architecture to be about structure and those components or elements and the relations or connectors between them form this structure.

IoT Architecture

IoT architecture may be treated as a system, which can be physical, virtual, or a hybrid, consisting of a collection of numerous active physical things, sensors, actuators, cloud services, specific IoT protocols, communication layers, users, developers, and enterprise layer. The IoT architecture is currently available for knowledge purpose:

''*A dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual 'Things' have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network*'' (Ray, P. P. 2018).

The most basic architecture is a ***three-layer architecture***. It has three layers, namely, the perception, network, and application layer. It defines various applications in which the IoT can be deployed, for example, smart homes, smart cities, and smart health. The three-layer architecture defines the main idea of the IoT, but it is not sufficient for research on research because it often focuses on the finer aspects of the IoT. Fig. 7 shows a simplified architecture of the IoT domain.
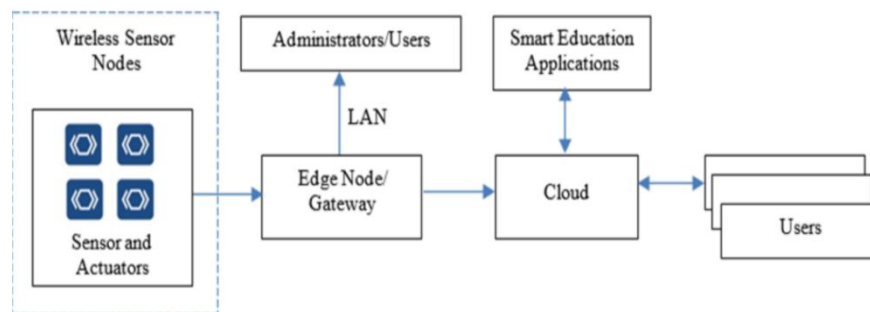
Fig. 7. The simplified architecture of the IoT domain

There is another architecture called ***five-layer architecture***, which additionally includes the processing and business layers. Some strategies applied when planning data-driven IoT architectures. These strategies help the designer simplify development, manage complexity, and ensure that IoT solutions remain scalable, flexible, and robust. These strategies are adopting *a layered architecture, security by design, automate operations, design for interoperability and follow a reference architecture*. There are many initiatives currently working towards standardizing IoT architectures to improve interoperability. IoT platform vendors and research partners collaborate through these initiatives to define IoT reference architectures. Some widely referenced IoT reference architectures include IoT-A (Bauer, M. 2007), IEEE P2413 and Industrial Internet Reference Architecture (IIRA). Reference architectures can be used as a template for developing IoT solutions. This approach helps to manage the complexity of IoT enabled smart education.

IoT Reference Model

A reference model is an abstract framework for understanding significant relationships among the entities of some environment (Armstrong, C., 2014). The IoT reference model provides the highest abstraction level for the definition of the IoT-A (Bauer, M. 2007). It is considered that current architecture models under development, such as the ITU-T model (ITU, 2014), the NIST model, the machine-to-machine (M2M) model or the architectural reference model.

The IoTRM aims at establishing a common grounding and a common language for IoT architectures and IoT systems. The IoT reference model introduces the main concepts of the IoT like devices, IoT services and virtual entities, and it introduces the relations between these concepts.   The IoTRM consists of a set of models, namely the domain, information and functionality. IoT reference models provide a description that is more abstract than what is inherent to actual systems and applications.

IoT Reference Architecture

A reference architecture maps onto software elements that implement the functionality defined in the reference model. It tries to show the most complete picture of what is involved in realizing the modelled entities. In the field of IoT, reference architecture handles requirements and forms a superset of functionalities, information structures, mechanisms and protocols (Weyrich, M. & Ebert, C. 2016). The key to enabling communication between all of these diverse "Things" is standardization. Reference architectures are of great help for standardization, as they define guidelines that can be used when planning the implementation of an IoT system. In order to achieve standardization, it is necessary to create high-level reference architectures like IoT-A.

The IoT reference architecture consists of a set of views and perspectives (Rozanski, N. & Woods, E.2011) that actually define the IoT architecture. The set of views is functional, information and deployment. The functional view focuses on the decomposition into functional components. The information view describes the information flows, the interaction between components and the structure of information, in compliance with the information model. The deployment view comes later on and shows how the "logical" component part of the functional view is deployed within the developed concrete software modules. The IoT reference architecture is providing a language for everyone involved and an abstract, but a rich view of the domain.

Main Focus of this Article

The focus of this article is to design a generic IoT architecture for smart education. To design an IoT architecture, it has to study the building methodology, literature review, quality attributes with some earlier works, architectural mythology, etc.

Building IoT Architecture

Building the IoT reference architecture (Maier, M. 2013& Maier, M. 2007) consist of the following four steps.

Step 1:　To conduct a qualitative literature study to define and describe the space of 'IoT in smart education' and related work and to gather typical requirements.

Step 2:　To design the reference architecture, it will develop and describe a methodology from literature about designing software architectures, especially reference architectures. Based on the gathered requirements, it describes the methodology and design principles for IoT Smart education.

Step 3:　To gather an overview of existing technologies available for handling and processing large volumes of heterogeneous data in a reasonable time.

Step 4:　To verify and refine the resulting reference architecture by applying it to case studies and mapping it against existing IoT architectures from academic and industry literature.

Following a design method (Galster, M. & Avgeriou, P, 2011), it is decided to loosely follow the proposed development process, which consists of the following six steps.

Step 1:　Decide on the reference architecture type

Step 2:　Select the design strategy

Step 3:　Empirical acquisition of data

Step 4:　Construction of the reference architecture

Step 5:　Enabling reference architecture with variability

Step 6:　Valuation of the reference architecture

While developing a generic IoT architecture, the result should be relevant to a specific domain, i.e. IoT in smart education, that is incorporate domain knowledge and fulfil domain requirements, while still being general enough to be applicable in different contexts.

Literature Study

The availability of newer and newer technology reflects on how the relevant processes should be performed in the current fast-changing digital era. This leads to the adoption of a variety of smart solutions in HEIs to enhance the quality of life and to improve the performances of both teachers and students.

Rehman, A.U. Abbasi, A.Z. & Shaikh, Z.A. (2008) presented the sensing with RFID technology that should benefit students and faculty with identification, tracking, smart lecture room, smart lab, room security, smart attendance taking, etc. Lane, J. & Finsel, A. (2014) emphasized the importance of big data movement and how it could help to build Smarter Universities. They examined how the Big Data movement could help build smarter Universities. Al Shimmary, M.K, Al Nayar & Kubba M.M. (2015) analyzed the advantages of using RFID and wireless sensor networks (WSN) technology in the development of smart universities. Yu, Z. (2011) argued that the development of wireless communication and pervasive computing technology, smarter campuses are built to benefit the faculty and students, manage the available resources and enhance user experience with proactive services.

From the review, RFID, WSN as well as IoT are expected to be significant parts of smart Universities and strongly support sending characteristics of smart universities. Technology-based teaching gives for better communication between learner and teacher. It also gives affordable education with satisfying learners and recruiter expectations for learners.

Vharkute, M. & Wagh, S. (2015) proposed a system combining the different applications of e-Learning with the help of IoT. This system gives a standard design framework for the educational system. It proposed the reference model to improve the learning outcomes of learners. According to Ahmed, E. et al, (2017), "IoT might serve as the backbone for the ubiquitous learning environment, and enable smart environments to recognize and identify objects, and retrieve information from the internet to facilitate their adaptation functionality".

In research by Hameed, S. Badii, A. & Cullen, A J. (2008), two groups' 25 learners each were enrolled in a similar course. Nevertheless, one group was taught using traditional methods and others using an interactive system of the Internet of things. After conducting various tests and analysis, they concluded, "IoT applied as a tool to support the teaching process, improves student academic performance." AjazMoharkan, Z. et al. (2017) gave a model of smart learning using the IoT and the gamification technique of e-Learning. This model was proposed to use both smart and engaging. Charmonman, S. et al. (2015) discussed IoT in e-Learning on IoT technology, IoT potentials to transform education, and IoT to improve student performance.

From the literature, it is reviewed that there are many IoT models are available but no IoT architecture is available to smart education, and hence, the objective is to design a generic IoT architecture to smart education. The proposed architecture is like the backbone of IoT if it is not robust and flexible, deploying IoT will take more time than required. The proposed architecture includes solutions to various issues such as interoperability, performance and security issues.

Challenges

The IoT domain will encompass an extremely wide range of technologies, from stateless to stateful, from extremely constrained to unconstrained, from hard real-time to soft real time. Therefore, single reference architecture cannot be used as a blueprint for all possible concrete implementations. While a reference model can probably be identified, it is likely that several reference architectures will co-exist in the IoT. This will also encompass several types of communications models such as Thing to Application Server, Thing to Human and Thing to Thing communication.

Architectural Methodology

The ISO/IEC/IEEE 2010 standard (IEEE, 2010) specifies how architectures should be designed. This standard motivates the terms and concepts used in describing the architecture and provides guidance on how architecture descriptions are captured and organized. It expresses architecture in terms of multiple views or more architecture models – domain model, information model, communication model and functional model.

As previously said, instead of developing an IoT architecture from scratch, this article uses existing IoT architectures as the basis such as the high-level architecture or architectural

reference model among others. Both architectures are conceptually based on the (IEEE, 2010) approach. The architecture analysis and design process for IoT systems need to consider all possible things and services for IoT smart education.

Solutions and Recommendations

IoT Architecture to Smart Education

This section presents the proposed IoT architecture to smart education (IoTASE) to design scenario description, goals, requirements, functional view, and the IoT reference architecture.

Scenario Description

Let assume teachers are interested in technology. They attempt to create a smart learning environment by automating teaching and learning operations using the cloud, mobile and ubiquitous learning aspects. They propose to their learners an environment for learning a course/subject, including with technology, a puzzle where learners could interact with each other to acquire skills related to those course/subject, their components and functioning modes. In the beginning, the teacher introduces the course. Then, the teacher proposes a collaborative activity where learners could interact with a subject the use of near field communication technology. Learners are equipped with near field communication enabled active devices to store information about the learning content. This collaborative activity aims to test the learners' comprehension level. Fig.9 shows that the scenario that provides a diversity of connected objects and several interactions' possibilities with the physical environment. Fig.8
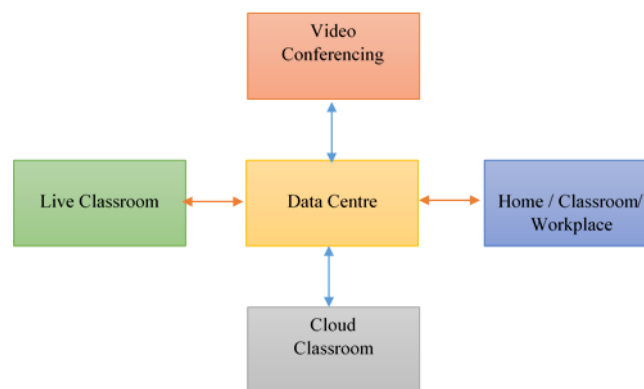
Fig.8. A functional model of IoT smart education

The main challenges here are to integrate physical learning objects with e-Learning objects and activities and to provide a flexible and scalable model/architecture for the learning environment.

Quality Attributes

It is important to select a minimum set of quality attributes that can be eligible for consideration while designing IoT architecture. The absence of quality in things or service can negatively affect the quality of the whole system. The quality attributes can be related to design-time and run-time quality of the things and services, quality of deployment infrastructure and quality of

communication infrastructure. The key quality attributes for IoT are *security, availability, scalability and elasticity, reliability, multi-tenancy, interoperability, etc.*

Design Goals

The design goals for the proposed IoT architecture are efficiency, manageability, mobility, security and privacy.

1. *Efficiency* in terms of power management of the different devices connected to the architecture.
2. *Manageability* includes centralized and distributed based control.
3. *Mobility* is considered when users move from one place to another.
4. *Quality of Service (QoS)* is for the prioritization of different data traffic from devices.
5. *Security and privacy* deal with various issues such as authentication, encryption, etc.

Requirements

To meet the above design goals, it identifies the requirements of the proposed architecture. According to (ITU, 2014), the requirements are divided into functional and non-functional requirements. The *non-functional* requirements refer to the requirements related to the implementation and operation of the IoT itself. The non-functional requirements for reference architecture include interoperability, scalability, reliability and availability. The *functional requirement* refers to the requirements related to the IoT actors, i.e., entities which are external to the IoT and that interacts with the IoT. The IoT functional requirements are application support, service, communication, device management, data management, security, confidentiality and privacy (IoT Series, 2014).

As smart things collect a huge amount of sensor data, compute and storage resources are required to analyze store, and process this data. Most of the things are mobile. It is very difficult to communicate to their changing location in the cloud data centre because of changing network conditions across different locations. There should be a reliable communication between the things and the cloud data centre.

Functional View

The functional view in Fig.9 defines the roles and the associated duties that the actors involved with it. The roles of actors dealing with IoT e-Learning platform are learning data producers, knowledge producers, virtualizes and learning service providers.
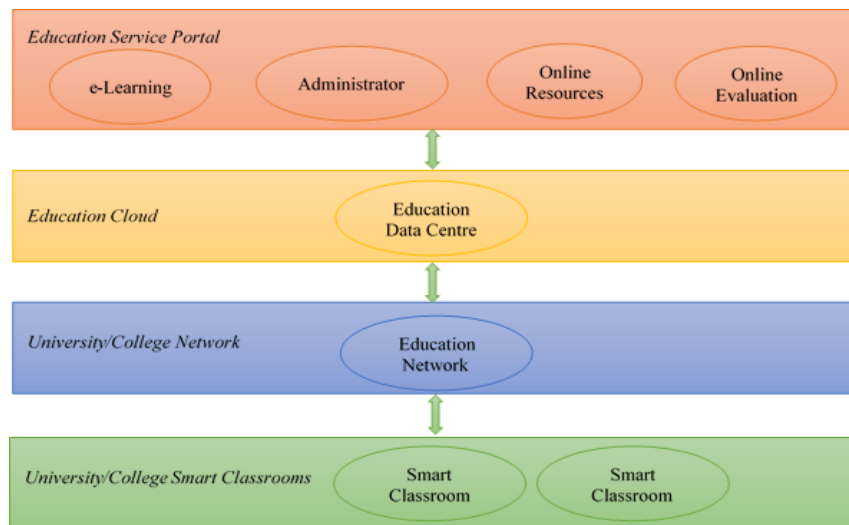
Fig.9. A functional model of IoT smart education

The proposed IoTASE considered various functional components and they are management, service, organization, IoT process, virtual entities, IoT communication service, and security.The management is user and configuration.The service organizationis dedicated to components that are used as tools for modelling, creating and supporting to access and make use of data available at the IoT platform. The IoT processcomponent allows for modelling either through graphical interface or scripting. The IoT communication service provides the IoT eco-system with a communication channel following the publish/subscribe paradigm. The securityintroduces various the functional components used for dealing with IoT e-Learning system. They are authentication and access control policies.

Features

The IoTASE endows the new features required by classroom-based e-learning system. IoTASE is a roadmap to integrate IoT in e-Learning platform in a *scalable* manner. Here, learners can use these features easily on strong bound of IoT in the smart classroom with enhanced device's data collection and sharing subjects, e-notes to everyone. IoT communication model to IoTASE with IoT requisite of the perfect network to observe, sense, collect data related to classroom activities and transferred to the learners. It is used to enhance feature in the current education system.

IoT Model

Fig.10, which is derived from Fig, 9, illustrates the IoT model to smart education and its levels. It is important to note that in the IoT, data flows in both directions.
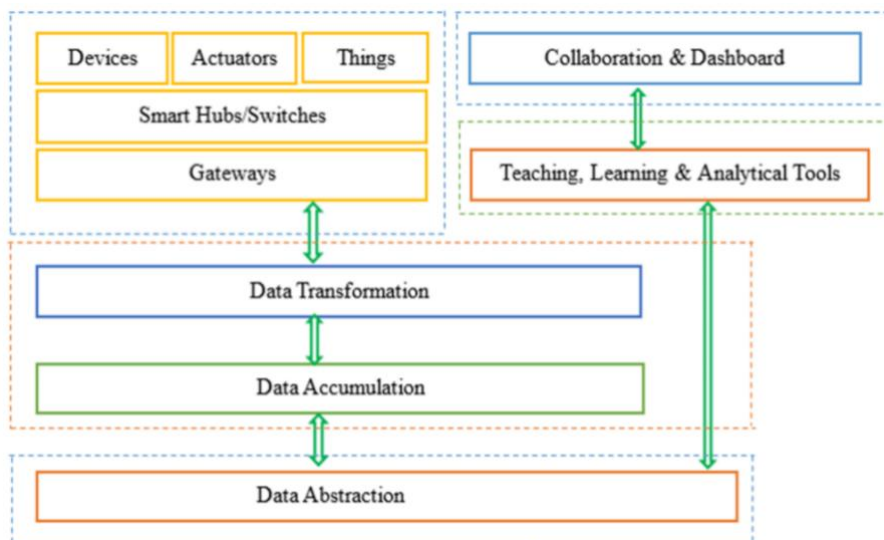
Fig.10. IoT model for smart education

The proposed IoT reference model starts with the device layer. Physical devices, actuators, things and controllers that might control multiple devices. Communications and connectivity are also concentrated in this layer. The most important function is reliable, timely information transmission. This includes transmissions between devices and the network, across networks and between the networks.

In data accumulation, data in motion is converted to data at rest. It captures data and puts it at rest; it is now usable by educational applications on a non-real-time basis. Applications access the data when necessary. It converts event-based data to query-based processing. The learning data abstraction requires multiple storage systems to accommodate IoT device data.

IoT Architecture

From a high-level perspective, IoTASE architecture follows a layered approach. The motivation behind the layered architecture view is the observation that typically different enablers have been designed to support the respective functionalities on the respective abstraction layers. In IoTASE, the aim is to choose standardized enablers that are best suited for the particular task and connecting them in a suitable way to combine the particular strengths while mitigating possible weaknesses. The characteristics of the proposed IoTASE includes the following:

- *Open standards–* The communication between the layers is based on open standards to ensure interoperability.
- *Defined Application Programming Interfaces (APIs)–* They allow for easy integration with existing applications and other IoT solutions.
- *Loosely coupled-* It is important that each layer can be used independently with other layers.
- *Modular -* Each layer should allow the features to be sourced from different suppliers.

- *Platform-independent* - Each layer should be independent of the host hardware and infrastructure.

The IoTASE provides flexibility for composability and extensibility to allow for a variety of technology choices driven by the specific solution requirements.

Fig.11. that is derived from Fig.10 shows the general architecture of IoTASE. The IoTASE consists of learning data collection layer, learning data integration layer, learning information access layer and learning application layer.
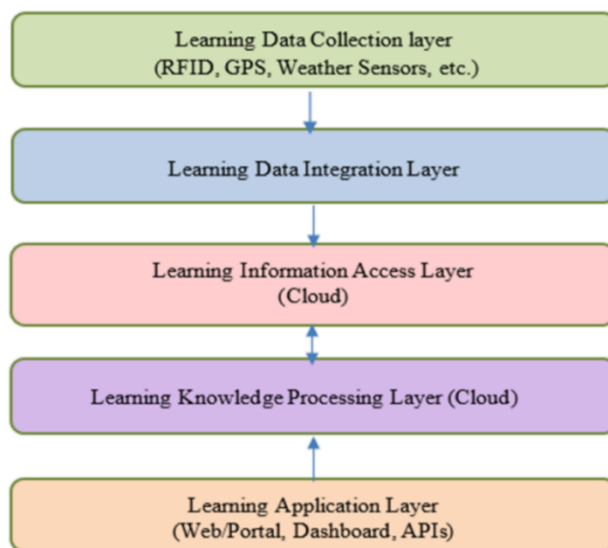
Fig.11. IoT Architecture to Smart Education

The *learning data collection layer* provides a connection to the physical world. It can utilize a large number of different device and communication technologies. Key technologies are sensors and actuators for sensing and controlling relevant aspects of the physical world. These sensors may be part of specific, often resource-constraint sensor nodes or be attached to sensor platforms running on more powerful devices, e.g. mobile phones, gateways or dedicated servers.

The *learning data integration layer* integrates and homogenizes the access to the data and services provided by the *learning data collection layer*. The components in higher layers do not have to deal with heterogeneous access and communication technologies. However, the data may still be in its raw form, i.e. there may not be any common abstraction with respect to the data provided by different devices and technologies. In addition to providing access to the data, the *learning data integration layer* may also enable the management of devices in the *learning data collection layer* and configuring and controlling the connectivity and communication.

The *learning information access layer* provides access to information on a higher, common abstraction level. Applications and components of the *learning knowledge processing layer* can request information, specifying what information they need, and they get back exactly the

requested information. The learning information access layer may provide different interaction styles, e.g. request-response or subscribe-notify. It integrates information from different sources in the learning data integration layer.

The *learning knowledge processing layer* process information and data, primarily information provided by the learning information access layer, to elicit higher-level knowledge, implicitly contained in the information. Smart applications may be supported through recommendations derived from the information while taking into account the application goals.

The *learning application layer* is the place for end-user applications. The applications primarily access learning knowledge-processing layer and *learning information access layer* components to have a good basis for optimally supporting the users in their respective tasks. Applications directly interact with the users to find out about their goals, which are then the basis for interacting with the *learning information access layer* and the *learning knowledge-processing layer* to retrieve the required information and knowledge.

With the IoT Platform, a broad spectrum of interoperable, cross-ecosystem IoT architecture can be built and optimized—with the added advantages of scalable compute, security from device to cloud, and data management and analytics support.

Performance Improvement and Evaluation

Smart education enjoys better operational efficiency and improved learning experiences for students. IoT technology can help cut costs for budget-constrained campuses and drastically improve public safety. Furthermore, implementing these new technologies allows learners to engage with science and technology. IoT will continue to grow, so it is imperative that schools begin to implement this technology in order to provide students with an enhanced learning environment that is adaptable to technological advancements. IoT devices provide substantial near real-time feedback, which can make resource management easier and immediate. With location tracking capabilities and asset monitoring, an educational institution could audit the use of vehicles to survey driver behaviour and implement preventative maintenance features.

Evaluation of the software architectures plays a critical role to verify the quality of a software system. To validate the work, it evaluates the system and user comprehension respectively.

- The IoTASE is based on Web service technology that use mobile devices to access more easily.
- The architecture is designed using back-end data-sharing model for aggregation and analysis.
- The IoTASE achieved interoperability between various IoT enabled systems through the cloud.
- It achieved scalability by connecting more devices to the cloud, thereby increasing the latency.
- It adopted a layered architecture.
- It followed a reference architecture that standardizing IoT architectures to improve interoperability.

The IoTASE includes solutions to performance and security issues. Based on the above-mentioned requirements and features, the IoTASE evaluated and listed in Table -2. For evaluation, it has 25 different decision criteria that may or may not be fulfilled by the proposed IoT platform. The weighted sum model (Guzman, L. 2001) is used for evaluation. Table 3 lists the architecture and design patterns used in IoTASE.

Table -2. Evaluation of IoTASE

Sl.No.	Requirements/Features	Rating	Sl.No.	Requirements/Features	Rating
1	Architectural patterns used	M	13	Number of connected devices	H
2	Compatibility with ZigBee, Wi-Fi, LPWAN	H	14	Range of the physical area	M
3	Context awareness	N	15	Scalability	Y
4	Cost range	M	16	Power consumption	Y
5	Data reliability	Y	17	Size of hardware	M
6	Data storage	Y	18	Support SOA approach	H
7	Data visualization	Y	19	Big data support	H
8	Device management	Y	20	Analytical tools	L
9	Dynamic adaptation	N	21	Open source technology	Y
10	Flexibility of Cloud architecture	H	22	Followed any reference architecture	Y
11	Support the heterogeneity and Interoperability	Y	23	Hardware / software availability	Y
12	Management of large volumes of data	M	24	Security, Privacy and Integrity	Y

Note - H – High, M – Medium, L – Low, Y – Yes, N - No

Table 3. Design Patterns used in IoTASE

Sl.No.	Quality Attributes	Design Tactics
1	Performance	Distributed Components, Pipes and Filters, Prioritized Message Queues
2	Security	Proxy, Authentication, Authorization, and Session Tokens
3	Modifiability	Layered, Services-Oriented, Model View Controller (MVC) Pattern
4	Availability	Components' Redundancy
5	Reliability	Redundancy of Components and Data, Cloud Infrastructure
6	Scalability	Data Input Queues and Load Balancing
7	Auditing	Event Logs
8	Multi-tenancy	Publisher/Subscriber Architecture
9	Interoperability	Broker Pattern

Table 2 and Table 3 shows commonly reported quality requirements, reusability and some improvements suggested in the IoT model and architecture.

The IoT is rich in approaches, concepts, and structures. Various initiatives have already delivered IoT models, architectures, and tools. However, Weyrich, M. & Ebert, C. (2016) stated that a convergence of approaches and standards is required for simplification. This raises the following issues.

- Many technologies exist to implement communication as efficient and secure communication.
- It is questionable whether device-oriented, real-time or the diversity of real-time will continue.
- Big-data analytics and the human-machine interface are close to the education business.

Conclusion

IoT is going to expand at a very rapid rate and with it, there are going to be huge advancements in every field. In the field of education, IoT will take e-Learning to the next level. It can leverage the power of IoT to implement a smart learning environment that facilitates better learning and greater retention rates. This advancement in education to produce better individuals in terms of skills and knowledge.

This article explains the need and significance of IoT, its applications with a specific focus on smart education. This article has also presented finally an education model which is both smart and engaging has been proposed. This article aimed to use e-Learning architecture with smart objects to design complex learning scenarios and keep track of the learner is learning experience. This architecture grants interoperability between standards and to provide context-aware activities to learners. However, IoT in smart learning is progressing very fast and so. A next-generation learning management system and experience application programming interfaces or APIs may enable real IoT integration and propel business training to the next level. LMS is part of e-Learning technology in future E-learning will be enabled with IoT.

Future work is proposed to incorporate blockchain technology and big data analysis to provide a secure framework for interconnectivity, accelerates the initiative of integrating emerging technologies and offers a development platform for researchers. They reduce attack surface and uncertainty in e-Learning business models. Blockchain and data analysis have challenges such as high computational costs of manufacturing nodes and verifying transactions. These technologies are in their early years of development and have promising indicators for overcoming these hurdles. They can collaboratively work to address the balance between privacy, utility and affordability for a safeguarded cognitive IoT world.

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ASSESSMENT OF FUZZY RELIABILITY FOR DETERIORATION OF UREA MANUFACTURING PLANT

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ABSTRACT: The present paper investigates mathematically an industrial problem related to urea manufacturing plant for the assessment of reliability and fuzzy reliability. Algebra of logic and Boolean function technique has been used for the purpose of formulation of mathematical model. Fuzzy reliability and mean time to fuzzy failure (MTTFF) has been computed in the addition of reliability and mean time to failure (MTTF) for the identified system by using fuzzy operators which is the expansion of Boolean function algorithm. For the improvement of practical utility of the model some particular cases are considered. The findings of the present paper will be highly useful to the urea manufacturing plant to enhance system performance. To draw the graph between different parameters of reliability mathematica has been used.

KEYWORDS:90B25, 60A86, 37A50, 06E30.

1. INTRODUCTION

Reliability is the probability that a system will perform its intended work satisfactory for a specified operating condition. Reliability of complex system is studied under various structural framework such as series structures, parallel structures, series-parallel structures, parallel-series structures, sequential structures, combined structures. In classical reliability analysis, the uncertainties in the failure probability and / or failure rate of system components or basic components can be propagated to find the uncertainty in the overall system failure probability. The present paper deals with a comparative study of probabilities and fuzzy set theoretic approach for reliability evaluation. Hence, fuzzy sets, which were developed by L.A.Zadeh thirty years ago, can help to overcome this situation. Experts utilize fuzzy sets to subjective describe the uncertainties of each given event failure rate and then perform mathematical operation to evaluate system reliability.

In this paper, the authors has investigated mathematically an industrial problem associated to urea manufacturing plant for its reliability as well as fuzzy reliability assessment. There are many processes which are using in manufacturing of the urea, like, synthesis, deterioration, crystallization and recovery. In this paper, the process of deterioration has been discussed with some redundant (parallel and standby) arrangements. The configuration of system has shown by fig-1. The total process of deterioration has been divided into six sub processes namely as. The subsystem (RHPA) is reboiler for high pressure absorber and it takes input. Subsystem (FFH) is

falling film heater. Subsystem (HPA) is high pressure absorber with an identical unit in standby redundancy that follows online through an perfect switching device on failure of main unit and (LPA) is low pressure absorber have two identical units in parallel redundancy. Subsystem (GS) is gas separator. Subsystem (HE) is heat exchanger. All these subsystems are connected in series and output comes through the subsystem (HE). This process of decomposition of urea is of 1-out-of-6:F nature. Reliability of the complex system has been computed in case of fuzzy failure rates follow either Weibull or exponential time distribution. An important fuzzy reliability parameter, viz; mean time to fuzzy failure (M.T.T.F.F.) with Reliability and mean time to failure (M.T.T.F.) has also been computed for considered system. The authors has used algebra of logics and Boolean function technique for the purpose of formulation of mathematical model. Some particular cases has also given to improve practical utility of the model. Graphical illustration followed by a numerical example has appended in last to highlight the important results of study.
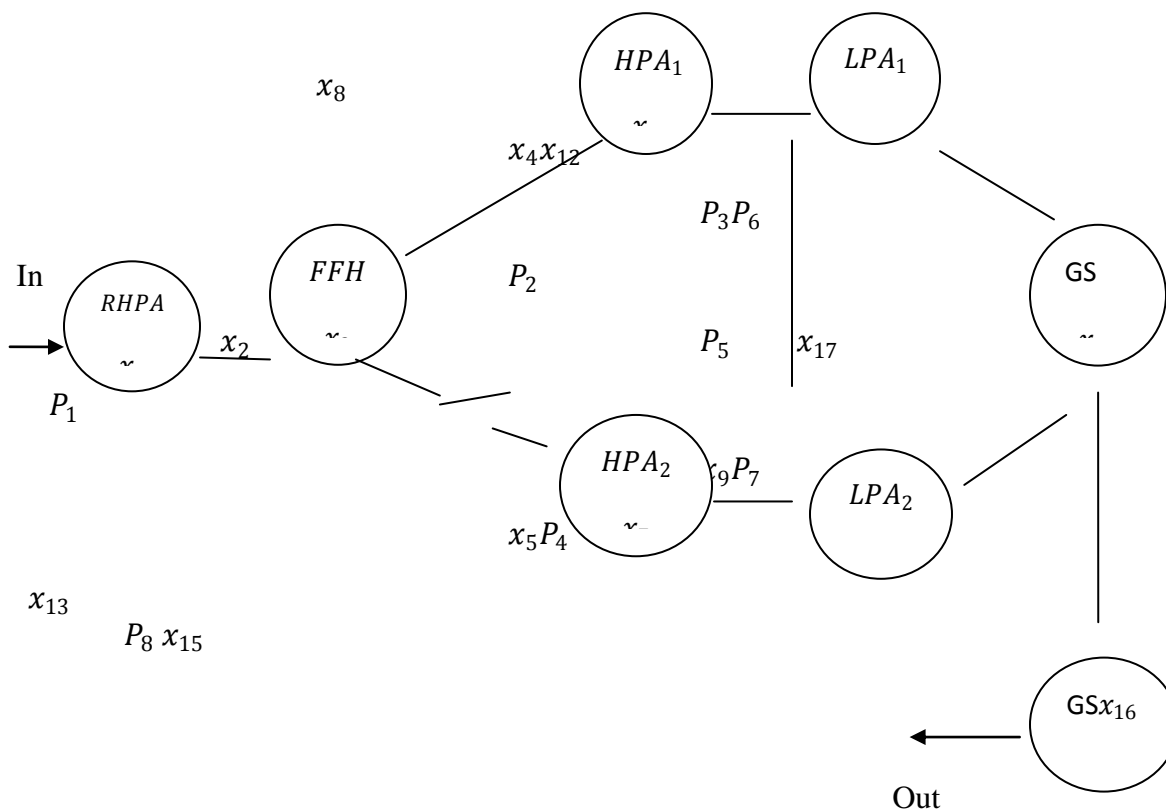
Fig-1 (System Configuration)

1. ASSUMPTIONS:
To study the model assumptions which are used are as follows:

(1) Initially, the all components of the system are in operable state.

(2) The reliability of each component is deterministic.

(3) Switching device used to online standby unit of subsystem (HPA)is perfect.

(4) For any failed component of the system, repair facility will not be consider.

(5) This system is 1-out-of-6:F system.

(6) Transition of any component from one state (either operable or failed) to other state of system is hundred percent reliable and takes time 0.

(7) Low pressure absorber (LPA) used in the system are parallel redundant.

(8) High pressure absorber (HPA) are on standby redundancy and failure of online High pressure absorber (HPA) other can be online through perfect switching device.

3. NOTATIONS USED FOR MATHEMATICAL FORMULATION OF MODEL:

x_1 / x_3 The state of reboiler for heat absorber (RHPA)/Falling film heater (FFH).

x_5 The state of switch board.

x_2 / x_4 The state of pipes P_1 / P_2 .

x_6 / x_7 The state of High pressure absorber HPA_1 / HPA_2.

$x_8 / x_9 / x_{17}$ The state of pipes $P_3 / P_4 / P_5$.

x_{10} / x_{11} The state of Low pressure absorber LPA_1 / LPA_2.

$x_{12} / x_{13} / x_{15}$ The state of pipes $P_6 / P_7 / P_8$.

x_{14} / x_{16} The state of Gas sapartor (GS)/Heat exchanger (HE).

∧/∨   Conjunction/Disjunction.

ANF   Fuzzy conjunction operator.

ORF   Fuzzy disjunction operator.

$\mu_s(s_i)$ Membership grade.

∩/∪   Intersection/Union.

x_i $= \begin{cases} 1, in\ good\ state \\ 0, in\ bad\ state \end{cases}$ (1)

x_i' The negation of $x_i, \forall i$.

$\tilde{x}_i'$ The fuzzy negation of $x_i, \forall i,$

R_i Reliability of component associated with the x_i^{th} state.

$\tilde{R}_i$ Fuzzy reliability of component associated with the x_i^{th} state.

$P_r(f = 1)$ Probability of function f for successful operation.

$\tilde{P}_r(f = 1)$ Fuzzy probability of function f for successful operation.

4. FUZZY NUMBERS AND THEIR OPERATIONS :

4.1 Fuzzy Number:If a fuzzy set is convexand normalized, and its membership
functions is defined in R and piecewisecontinuous, it is called as "fuzzy number". So

fuzzy number (fuzzy set) represents a real number interval whose boundary is fuzzy.

4.2 Triangular fuzzy number: It is a fuzzy number represented with three points as follows:
$$A = (a_1, a_2, a_3)$$

This representation is interpreted as membership functions (Fig-2)

$$\mu_A(x) = \begin{cases} 0 & x < a_1 \\ \frac{x - a_1}{a_2 - a_1} & a_1 \leq x \leq a_2 \\ \frac{a_3 - x}{a_3 - a_2} & a_1 \leq x \leq a_2 \\ 0 & x > a_3 \end{cases} \qquad (2)$$

If we get crisp interval by $\alpha -$cut operations, interval A_a shall be obtained as

follows $\forall \alpha \in [0,1]$

$$\frac{a_1^{(\alpha)} - a_1}{a_2 - a_1} = \alpha = \frac{a_3 - a_3^{(\alpha)}}{a_3 - a_2} \qquad (3$$

$\mu_A(x)$
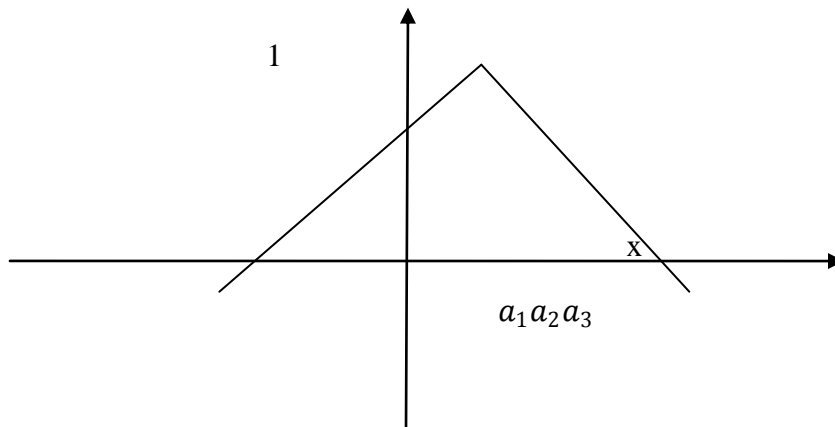
Fig-2 (Triangular fuzzy number)

We get $a_1^{(\alpha)} = (a_2 - a_1)\alpha + a_1$ (4)

$$a_3^{(\alpha)} = -(a_3 - a_2)\alpha + a_3 \tag{5}$$

$$A_\alpha = [a_1^{(\alpha)}, a_3^{(\alpha)}] \tag{6}$$

$$A_\alpha = [(a_2 - a_1)\alpha + a_1, -(a_3 - a_2)\alpha + a_3] \tag{7}$$

4.3 Addition of triangular fuzzy numbers.

Suppose triangular fuzzy numbers A and B are defined as,

$A = (a_1, a_2, a_3), B = (b_1, b_2, b_3)$ then.
$$A_\alpha + B_\alpha = [(a_1 + b_1) + \{(a_2 + b_2) - (a_1 + b_1)\}\alpha,$$
$(a_3 + b_3) - \{(a_3 + b_3) - (a_2 + b_2)\}\alpha] \tag{8}$
To obtain the membership function $\mu_{A+B}(x)$, equating to x of each component using $\alpha = 0$ & 1 in (8) solving for α then we get,

$$\mu_{A+B}(x) = \begin{cases} 0 & x < (a_1 + b_1) \\ \frac{x - (a_1 + b_1)}{(a_2 + b_2) - (a_1 + b_1)} & (a_1 + b_1) \leq x \leq (a_2 + b_2) \\ \frac{(a_3 + a_3) - x}{(a_3 + a_3) - (a_2 + b_2)} & (a_2 + b_2) \leq x \leq (a_3 + a_3) \\ 0 & x > (a_3 + a_3) \end{cases} \tag{9}$$

4.4 Subtraction of triangular fuzzy numbers.

The same process can be adopt for the subtraction of triangular fuzzy numbers like addition

then membership function $\mu_{A-B}(x)$, is obtained as.

$$\mu_{A-B}(x) = \begin{cases} 0 & x < (a_1 - b_3) \\ \frac{x - (a_1 - b_3)}{(a_2 - b_2) - (a_1 - b_3)} & (a_1 - b_3) \leq x \leq (a_2 - b_2) \\ \frac{(a_3 - b_1) - x}{(a_3 - b_1) - (a_2 - b_2)} & (a_2 - b_2) \leq x \leq (a_3 - b_1) \\ 0 & x > (a_3 - b_1) \end{cases} \tag{10}$$

4.5 Multiplication of triangular fuzzy numbers.
If we are finding the membership function $\mu_{A \times B}(x)$ for the multiplication of two fuzzy numbers A and B then it is obtained that it is not necessary for any two fuzzy numbers A and B the multiplication is triangular fuzzy number

$$\mu_{A \times B}(x) = f(x) = \begin{cases} -D_1 + [D_1^2 + \frac{(x - a_1 b_1)}{T_1}]^{1/2}, & a_1 b_1 \leq x \leq a_2 b_2 \\ -D_2 + [D_2^2 + \frac{(x - a_3 b_3)}{U_1}]^{1/2}, & a_2 b_2 \leq x \leq a_3 b_3 \\ 0 & Otherwise \end{cases} \qquad (11)$$

Where, $D_1 = \frac{T_1}{2T_2}, D_2 = -\frac{U_1}{2U_2}$

$$T_1 = (a_2 - a_1)(b_2 - b_1), T_2 = \{a_1(b_2 - b_1) + b_1(a_2 - a_1)\}$$

$$U_1 = (a_3 - a_2)(b_3 - b_2), U_2 = \{a_3(b_3 - b_2) + b_3(a_3 - a_2)\}$$

4.6 Trapezoidal fuzzy number: : It is a fuzzy number represented with four points as follows $A = (a_1, a_2, a_3, a_4)$ and operations on trapezoidal fuzzy numbers are defined by same way of triangular fuzzy numbers also like triangular fuzzy numbers the multiplication of trapezoidal fuzzy numbers need not be trapezoidal.

5. OPERATORS IN FUZZY EXPRESSION :

Using algebraic operations on fuzzy numbers (triangular or trapezoidal) we can obtain fuzzy operators FNOT, ANF and DNF corresponding to Boolean operators NOT, AND and OR respectively as follows.

5.1 FNOT: If a fuzzy event "i" is represented by a possibility function $\tilde{p}_i$ the generalized Boolean Operator NOT to be denoted by FNOT and defined as for triangular fuzzy numbers
$$\tilde{p}_i = (a_{i1}, a_{i2}, a_{i3})$$
FNOT $p_i = 1 - p_i = 1 - (a_{i1}, a_{i2}, a_{i3}) = (1 - a_{i1}, 1 - a_{i2}, 1 - a_{i3})$
5.2 ANF: If $\widetilde{p_1}, \widetilde{p_2} \ldots \ldots \ldots \widetilde{p_n}$ are possibility function of n basic events and $\widetilde{p_y}$ be he resulting event
defined by

$$\widetilde{p_y} = ANF(\widetilde{p_1}, \widetilde{p_2} \ldots \ldots \ldots \widetilde{p_n}) = \prod_{i=1}^{n} \tilde{p}_i$$

Where $\prod$ denotes fuzzy multiplication

$$\widetilde{p_y} = \prod_{i=1}^{n}(a_{i1}, a_{i2}, a_{i3}) = (\prod_{i=1}^{n} a_{i1}, \prod_{i=1}^{n} a_{i2}, \prod_{i=1}^{n} a_{i3})$$

5.3 ORF: Similarly the resulting event $\widetilde{p_y}$ for fuzzy disjunction defined by

$$\widetilde{p_y} = ORF(\widetilde{p_1}, \widetilde{p_2} \ldots \ldots \ldots \widetilde{p_n}) = 1 - \prod_{i=1}^{n}(1 - \hat{p}_i)$$

$$\widetilde{p_y} = 1 - \prod_{i=1}^{n}\{1 - (a_{i1}, a_{i2}, a_{i3})\}$$

$$= \{1 - \prod_{i=1}^{n}(1 - a_{i1}), 1 - \prod_{i=1}^{n}(1 - a_{i2}), 1 - \prod_{i=1}^{n}(1 - a_{i3})\}$$

6. APPROXIMATION OF FUZZY NUMBERS FOR BASIC EVENTS.

By the data of occurrence related to any basic events, an appropriate fuzzy number (triangular or trapezoidal) can be allocating to every basic event. Let a basic event can be allocated by n triangular fuzzy numbers $A_i = (a_i - c_i, a_i, a_i' + c_i), i = 1, 2, \ldots \ldots \ldots n$ by n distinct n experts. We have to select a single fuzzy number from these n fuzzy numbers for any particular event that produce the judgment of all experts. Let $B = (b - d, b, b + d)$ be the fuzzy numbers by all experts' decision. The value of b and d can be determined in such a way that the fuzzy number B has minimum variance with all $A_i's$ for this we find $B - A_i$ which is again a triangular fuzzy number. $B - A_i$ gives the result for best approximation for B.

Let us suppose that $S = \sum[2(d - c_i)^2]$, then S will be minimum if $d = \frac{1}{n}\sum_{i=1}^{n} c_i$. To find the value of parameter b, we considering $D = \max_{1 \leq i \leq n}|b - a_i|$,D is absolute deviation and it will be minimum for $b = \frac{\max_{1 \leq i \leq n} a_i + \min_{1 \leq i \leq n} a_i}{2}$

Similarly for trapezoidal fuzzy number let $A_i = (a_i - c_i, a_i, a_i', a_i' + c_i), i = 1, 2 \ldots \ldots \ldots n$ represent the possibility of failure for any basic events then $B = (b - d, b, b', b' + d)$ the fuzzy number which has minimum variance for above n numbers. Then parameters b, b', d can be obtained as

$$d == \frac{1}{n}\sum_{i=1}^{n} c_i , b = \frac{\max_{1 \leq i \leq n} a_i' + \min_{1 \leq i \leq n} a_i'}{2} , b' = \frac{\max_{1 \leq i \leq n} a_i + \min_{1 \leq i \leq n} a_i}{2}$$

7. MATHEMATICAL FORMULATION OF THE MODE:

By the application of Boolean functions technique, the condition of competence for successful operations of the considered system in terms of logical matrix is expressed as:

$$F(x_1, x_2 --x_{16}, x_{17}) = \begin{vmatrix} x_1 & x_2 & x_3 & x_4 & x_6 & x_8 & x_{10} & x_{12} & x_{14} & x_{15} & x_{16} \\ x_1 & x_2 & x_3 & x_4 & x_6 & x_8 & x_{17} & x_{11} & x_{13} & x_{14} & x_{15} & x_{16} \\ x_1 & x_2 & x_3 & x_5 & x_7 & x_9 & x_{11} & x_{13} & x_{14} & x_{15} & x_{16} \\ x_1 & x_2 & x_3 & x_5 & x_7 & x_9 & x_{17} & x_{12} & x_{12} & x_{14} & x_{15} & x_{16} \end{vmatrix} \qquad (12)$$

8. SOLUTION OF MATHEMATICAL MODEL:

By technique to Boolean algebra the equation (12) may be written as:

$$= x_1 x_2 x_3 x_{14} x_{15} x_{16} \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{10} & x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & x_{10} & x_{12} \end{vmatrix} \end{vmatrix} = x_1 x_2 x_3 x_{14} x_{15} x_{16} f \qquad (13)$$

Where,

$$f = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{10} & x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & x_{10} & x_{12} \end{vmatrix} \end{vmatrix} \qquad (14)$$

Equation (14) have five arguments namely $(x_{10}, x_{11}, x_{12}, x_{13}, x_{17})$ twice. Therefore we can use

expansion from any one of five arguments let us take expansion from x_{10}.

$$f = \begin{vmatrix} x_{10}' \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 0 & x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & 0 & x_{12} \end{vmatrix} \end{vmatrix} \\ x_{10} \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 1 & x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & 1 & x_{12} \end{vmatrix} \end{vmatrix} \end{vmatrix} = x_{10}' Y_0 \vee x_{10} Y_1 \qquad (15)$$

Where,

$$Y_0 = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 0 & x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & 0 & x_{12} \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_4 & x_6 & x_8 & x_{17} & x_{11} & x_{13} \\ x_5 & x_7 & x_9 & x_{11} & x_{13} \end{vmatrix} \qquad (16)$$

$$= x_{11} x_{13} \begin{vmatrix} x_4 & x_6 & x_8 & x_{17} \\ x_5 & x_7 & x_9 \end{vmatrix} \qquad (17)$$

$$Y_1 = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 1 & x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & 1 & x_{12} \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{12} \\ x_{17} & x_{11} & x_{13} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & x_{13} \\ x_{17} & x_{12} \end{vmatrix} \end{vmatrix} \qquad (18)$$

In equation (17) all arguments appearing only once, hence Y_0 cannot be iterated but in equation (18) the four arguments $(x_{11}, x_{12}, x_{13}, x_{17})$ for Y_1 are appearing twice therefore we can take again expansion of any one of them let us choose x_{13} for the expansion as follows.

$$Y_1 = \begin{vmatrix} x'_{13} \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{12} \\ x_{17} & x_{11} & 0 \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & 0 \\ x_{17} & x_{12} \end{vmatrix} \end{vmatrix} \\ x_{13} \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{12} \\ x_{17} & x_{11} & 1 \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & 1 \\ x_{17} & x_{12} \end{vmatrix} \end{vmatrix} \end{vmatrix} = x'_{13} Y_{10} \vee x_{13} Y_{11} \qquad (19)$$

Where,

$$Y_{10} = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{12} \\ x_{17} & x_{11} & 0 \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & 0 \\ x_{17} & x_{12} \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_4 & x_6 & x_8 & x_{12} \\ x_5 & x_7 & x_9 & x_{17} & x_{12} \end{vmatrix} \tag{20}$$

$$= x_{12} \begin{vmatrix} x_4 & x_6 & x_8 \\ x_5 & x_7 & x_9 & x_{17} \end{vmatrix} \tag{21}$$

and,

$$Y_{11} = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{12} \\ x_{17} & x_{11} & 1 \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} & 1 \\ x_{17} & x_{12} \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} x_{12} \\ x_{17} & x_{11} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} \\ x_{17} & x_{12} \end{vmatrix} \end{vmatrix} \tag{22}$$

In equation (21) all arguments appearing only once, hence Y_{10} cannot be iterated but in equation (22) the arguments (x_{11}, x_{12}, x_{17}) for Y_{11} are appearing twice therefore for the next equation we can take expansion of x_{12} then.

$$Y_{11} = \begin{vmatrix} x_{12}' \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 0 \\ x_{17} & x_{11} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} \\ x_{17} & 0 \end{vmatrix} \end{vmatrix} \\ x_{12} \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 1 \\ x_{17} & x_{11} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} \\ x_{17} & 1 \end{vmatrix} \end{vmatrix} \end{vmatrix} = x_{12}' Y_{110} \vee x_{12} Y_{111} \tag{23}$$

Where,

$$Y_{110} = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 0 \\ x_{17} & x_{11} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} \\ x_{17} & 0 \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_4 & x_6 & x_8 & x_{17} & x_{11} \\ x_5 & x_7 & x_9 & x_{11} \end{vmatrix} \tag{24}$$

$$= x_{11} \begin{vmatrix} x_4 & x_6 & x_8 & x_{17} \\ x_5 & x_7 & x_9 & \end{vmatrix} \tag{25}$$

$$Y_{111} = \begin{vmatrix} x_4 & x_6 & x_8 \begin{vmatrix} 1 \\ x_{17} & x_{11} \end{vmatrix} \\ x_5 & x_7 & x_9 \begin{vmatrix} x_{11} \\ x_{17} & 1 \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_4 & x_6 & x_8 \\ x_5 & x_7 & x_9 \end{vmatrix} \begin{vmatrix} x_{11} \\ x_{17} \end{vmatrix} \tag{26}$$

From equation (25) and (26) we observe that all arguments appearing once hence both Y_{110} and Y_{111} are non iterated and not further expansion are required hence from equation (14) by using (5) through (26) we obtain.

$$f = \begin{vmatrix} x_{10}' & Y_0 \\ x_{10} & \begin{vmatrix} x_{13}' & x_{10} \\ x_{13} & \begin{vmatrix} x_{12}' & Y_{110} \\ x_{12} & Y_{111} \end{vmatrix} \end{vmatrix} \end{vmatrix} = \begin{vmatrix} x_{10}' & Y_0 \\ x_{10} & x_{13}' & Y_{10} \\ x_{10} & x_{13} & x_{12}' & Y_{110} \\ x_{10} & x_{13} & x_{12} & Y_{111} \end{vmatrix} = \begin{vmatrix} H_1 \mid Y_0 \\ H_2 \mid Y_{10} \\ H_3 \mid Y_{110} \\ H_4 \mid Y_{111} \end{vmatrix} \tag{27}$$

Where,

$$H_1 = x_{10}', H_2 = x_{10}x_{13}', H_3 = x_{10}x_{12}x_{13}', H_4 = x_{10}x_{12}x_{13}$$

H_1, H_2, H_3 and H_4 are pair wise disjoint.

Therefore

$$P_r(f=1) = \sum_{i=1}^{4} P_r(H_i)P_r(\frac{f}{H_i}) = \sum_{i=1}^{4} P_r(H_i)P_r(z_i) \tag{28}$$

Where $z_i = \dfrac{f}{H_i}$ and $z_1 = Y_0, z_2 = Y_{10}, z_3 = Y_{110}, z_4 = Y_{111}$

Also $\{H_1, H_2, H_3, H_4\}$ is a complete group of incompatible hypothesis. Then $P_r(\dfrac{f}{H_i})$ form the conditional probability of a good state of the system for each hypothesis. Then equation (28) is

$$P_r(f=1) = P_r(x_{10}')P_r(Y_0) + P_r(x_{10}x_{13}')P_r(Y_{10}) + P_r(x_{10}x_{13}x_{12}')P_r(Y_{110}) + P_r(x_{10}x_{12}x_{13})P_r(Y_{111}) \tag{29}$$

Now if R_i be the reliability of the component associated with the x_i^{th} state then (28) gives

$$
\begin{aligned}
P_r(f=1) &= (1-R_{10})\{1-(1-R_4R_6R_8R_{17})(1-R_5R_7R_9)\} \\
&+ R_{10}(1-R_{13})R_{12}\{1-(1-R_4R_6R_8)(1-R_5R_7R_9R_{17})\} \\
&+ R_{10}R_{13}(1-R_{12})R_{11}\{1-(1-R_4R_6R_8R_{17})(1-R_5R_7R_9)\} \\
&+ R_{10}R_{12}R_{13}[1-(1-R_4R_6R_8)\{1-R_5R_7R_9\{1-(1-R_{11})(1-R_{17})\}\}]
\end{aligned}
\tag{30}
$$

Finally, the probability of successful operation i.e. reliability of the system as a whole is given

by

$$
\begin{aligned}
R_s &= P_r\{F(x_1,x_2........x_{17})=1\} \\
&= P_r(x_1x_2x_3x_{14}x_{15}x_{16}).P_r(f=1) \\
&= R_1R_2R_3R_{14}R_{15}R_{16}[R_5R_7R_9R_{11}R_{13} + R_4R_6R_8R_{11}R_{13}R_{17} + R_5R_7R_9R_{10}R_{12}R_{17} + R_4R_5R_6R_7R_8R_9R_{10}R_{11}R_{12}R_{13}R_{17} \\
&\quad + R_4R_6R_8R_{10}R_{12} + R_4R_5R_6R_7R_8R_9R_{10}R_{11}R_{12}R_{13}R_{17} - R_4R_5R_6R_7R_8R_9R_{11}R_{13}R_{17} - R_4R_5R_6R_7R_8R_9R_{10}R_{12}R_{17} \\
&\quad - R_5R_7R_9R_{10}R_{11}R_{12}R_{13}R_{17} - R_4R_6R_8R_{10}R_{11}R_{12}R_{13}R_{17} - R_4R_5R_6R_7R_8R_9R_{10}R_{11}R_{12}R_{13}]
\end{aligned}
\tag{31}
$$

9. SOME PARTICULAR CASES:

9.1 Case I:If the reliability of each component of considered system is R:

In this case equation (31) gives:

$$
\begin{aligned}
R_s &= R^6[2R^5 + 2R^6 - 2R^8 - 2R^9 - R^{10} + 2R^{11}] \\
&= R^{11}[2 + 2R - 2R^3 - 2R^4 - R^5 + 2R^6]
\end{aligned}
\tag{32}
$$

For fuzzy reliability, when the reliability of each component is $\tilde{R}$

$$
\begin{aligned}
\tilde{R}_s &= \tilde{R}^6[2\tilde{R}^5 + 2\tilde{R}^6 - 2\tilde{R}^8 - 2\tilde{R}^9 - \tilde{R}^{10} + 2\tilde{R}^{11}] \\
&= \tilde{R}^{11}[2 + 2\tilde{R} - 2\tilde{R}^3 - 2\tilde{R}^4 - \tilde{R}^5 + 2\tilde{R}^6]
\end{aligned}
\tag{33}
$$

9.2 Case II: When all failures follow Weibull time distribution:

Let $a_i(i=1,2........17)$ be the failure rate of x_i^{th} state of considered system and an integer
parameter $\alpha > 0$ then in this case, reliability of the whole system, at instant t, can be obtained
from equation (31) as:

$$
R_{sw}(t) = \sum_{i=1}^{6} \exp\{-\lambda_i t^\alpha\} - \sum_{j=1}^{5} \exp\{-\mu_j t^\alpha\}
\tag{34}
$$

Where λ_i and μ_j for $\{i = 1,2,3,4,5,6\}, \{j = 1,2,3,4,5\}$ are given as under

$$\lambda_1 = c + a_5 + a_7 + a_9 + a_{11} + a_{13}$$

$$\lambda_2 = c + a_4 + a_6 + a_8 + a_{11} + a_{13} + a_{17}$$

$$\lambda_3 = c + a_5 + a_7 + a_9 + a_{10} + a_{12} + a_{17}$$

$$\lambda_4 = c + a_4 + a_6 + a_8 + a_{10} + a_{12}$$

$$\lambda_5 = \lambda_6 = c + a_4 + a_5 + a_6 + a_7 + a_8 + a_9 + a_{10} + a_{11} + a_{12} + a_{13} + a_{17}$$

$$\mu_1 = c + a_4 + a_5 + a_6 + a_7 + a_8 + a_9 + a_{11} + a_{13} + a_{17}$$

$$\mu_2 = c + a_4 + a_5 + a_6 + a_7 + a_8 + a_9 + a_{10} + a_{12} + a_{17}$$

$$\mu_3 = c + a_4 + a_6 + a_8 + a_{10} + a_{11} + a_{12} + a_{13} + a_{17}$$

$$\mu_4 = c + a_5 + a_7 + a_9 + a_{10} + a_{11} + a_{12} + a_{13} + a_{17}$$

$$\mu_5 = c + a_4 + a_5 + a_6 + a_7 + a_8 + a_9 + a_{10} + a_{11} + a_{12} + a_{13}$$

$$c = a_1 + a_2 + a_3 + a_{14} + a_{15} + a_{16}$$

For the fuzzy reliability

$$\tilde{R}_{fsw}(t) = \sum_{i=1}^{6} \exp\{-\tilde{a}\lambda_i t^\alpha\} - \sum_{j=1}^{5} \exp\{-\tilde{b}\mu_j t^\alpha\} \qquad (35)$$

9.3 Case III: When all failures follow exponential time distribution:

Exponential time distribution is a particular case of Weibull time distribution for $\alpha = 1$

Hence, the reliability of whole system at an instant "t" in this case, equation (34) is gives:

$$R_{SE}(t) = \sum_{i=1}^{6} \exp\{-\lambda_i t\} - \sum_{j=1}^{5} \exp\{-\mu_j t\} \qquad (36)$$

$$\tilde{R}_{fSE}(t) = \sum_{i=1}^{6} \exp\{-\tilde{a}\lambda_i t\} - \sum_{j=1}^{5} \exp\{-\tilde{b}\mu_j t\} \qquad (37)$$

Also, in this case, the reliability parameter M.T.T.F. is given by

$$M.T.T.F = \int_0^\infty R_{SE}(t)dt = \sum_{i=1}^{6} \{\frac{1}{\lambda_1}\} - \sum_{j=1}^{5} \{\frac{1}{\mu_j}\} \qquad (38)$$

Then an important reliability parameter M.T.T.F.F. is given by

$$M.T.T.F.F = \int_0^\infty \widetilde{R}_{fSE}(t)dt = \sum_{i=1}^6 \{\frac{1}{\tilde{a}\lambda_i}\} - \sum_{j=1}^5 \{\frac{1}{\tilde{b}\mu_j}\} \qquad (39)$$

11. NUMERICAL COMPUTATION:

For a numerical computation and for a fuzzy aspect the numerical computation will be considered by fuzzification and then defuzzification of the values which will cover up the maximum uncertainties, let us consider the values: let us consider the values.

(i) Set $a_i(i=1,2,....,17) = a = 0.002$ and $\alpha = 2$ and $t = 0,1.......10$ in equation (34) then by table-1.

(ii) Set $a_i(i=1,2,....,17) = a = 0.0012$ and $\alpha = 2$, $\tilde{a} = \tilde{b} = 0.0011$ and $t = 0,1.......10$ in equation (35) then by table-1.

(iii) Set $a_i(i=1,2,....,17) = a = 0.002$ and $t = 0,1.......10$ in equation (36) then by table-2.

(iv) Set $a_i(i=1,2,....,17) = a = 0.0012$, $\tilde{a} = \tilde{b} = 0.0011$ and $t = 0,1.......10$ in equation (37) then by table-2.

(v) Set $a_i(i=1,2,....,17) = a = 0,0.1...........1.0$ in equation (38) then by table-3.

(vi) Set $a_i(i=1,2,....,17) = a = 0,0.1...........1.0$ and $\tilde{a} = \tilde{b} = 0.0011$ in equation (39) then by

(vii) table-3.

t	RSW	RFSW
0	1	1
1	0.99974	0.99999
2	0.98797	0.99996
3	0.96332	0.99992
4	0.91571	0.99985
5	0.84052	0.99977
6	0.73926	0.99967
7	0.61457	0.99955
8	0.49302	0.99941
9	0.37168	0.99925
10	0.26518	0.99908

t	RSE	RFSE
0	1	1
1	0.99974	0.99999
2	0.99496	0.99998
3	0.9917	0.99997
4	0.98797	0.99996
5	0.98382	0.99995
6	0.97925	0.99995
7	0.9743	0.99994
8	0.96898	0.99993
9	0.96332	0.99992
10	0.95734	0.99991

a	MTTF	MTTFF
0	∞	∞
0.1	1.232750	1158.6
0.2	0.616374	579.279
0.3	0.410916	386.186
0.4	0.308187	289.64
0.5	0.246550	231.22
0.6	0.254580	193.093
0.7	0.176107	165.508
0.8	0.154093	144.82
0.9	0.136972	128.729
1	0.123275	115.856

Table 3
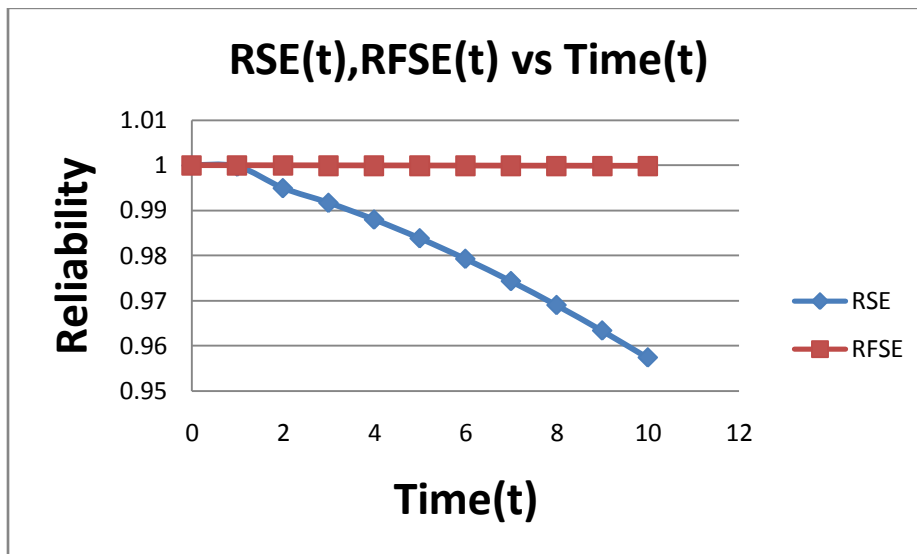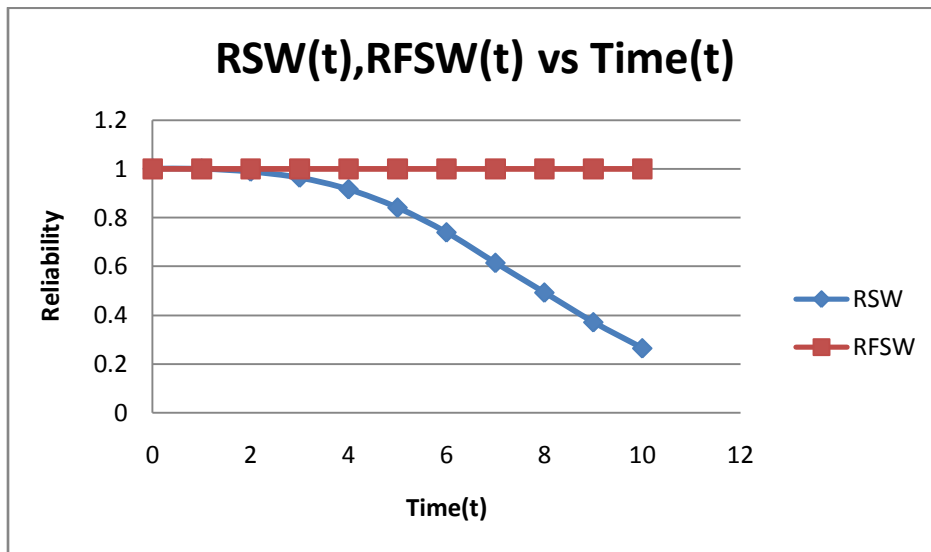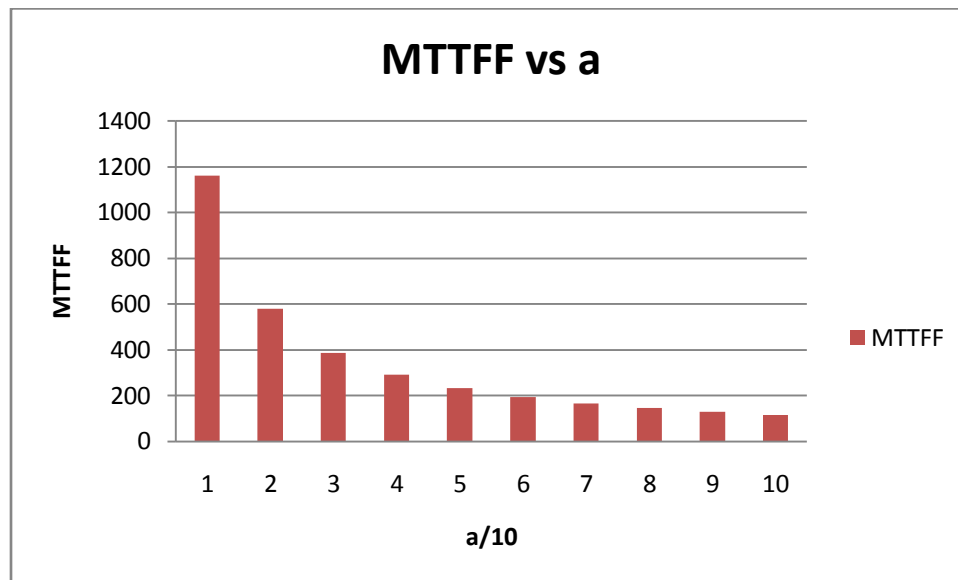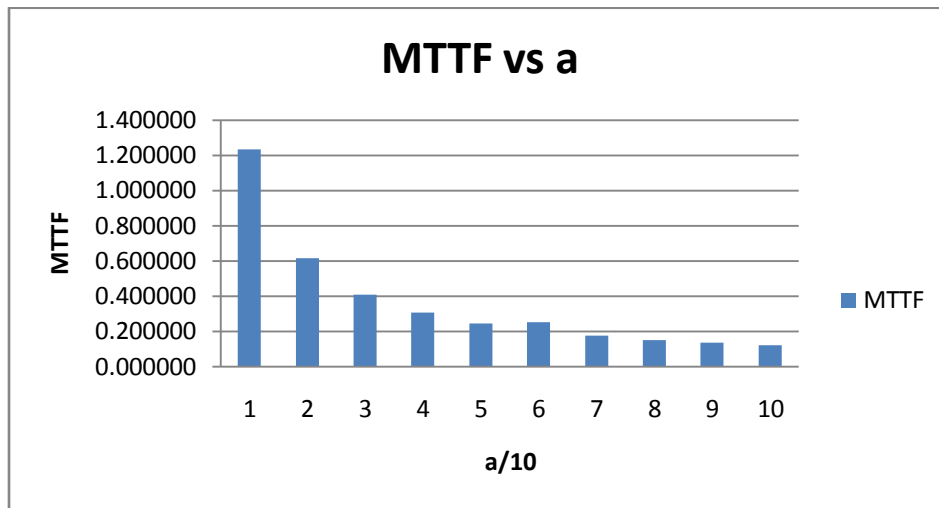
Table 1   Table 2

11. CONCLUSION

The investigation of table-1 & table-2 conclude that the value of reliability function declined speedily when failure follows Weibull distribution but when exponential distribution takes place it decreases approximately. When we observe the graphs of fuzzy reliability in both distributions either Weibull or exponential it decreases in graceful manner therefore from this discussion exponential time distribution is comparatively be.er for reliability and fuzzy reliability functions. By observation of table-3 M.T.T.F. decreases ruinously for small value of failure rate λ but decreases evenly for large value of λ while M.T.T.F.F. diminished in authentic way than the M.T.T.F. for small values of failure rate. In this paper authors try to investigate a new approach for estimation the failure rate based on fuzzy set theory which is more true for system behavior. Also the mortification of system is considered to be fuzzy in nature rather than crisp.

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DIGITAL MARKETING: A TOOL FOR CAREER MAKING AND DEVELOPMENT – A REVIEW

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Abstract

Due to the change and advancement in technology the gap between employment opportunities and employment seeking people is continuously widening.With this change everyone has to accept and adapt new techniques for career making and development.Todys generation born up with gadgets and most of us are using smartphones,tablets,laptop frequently.If we develop the digital skills, it becomes easy for us to survive.With this research paper we tried to highlight the various career making and development fields by using various facts and figures and compare it with todays and future scenario. Search Engine Optimization(SEO)**, Search Engine Marketing (SEM),**Web Analyst**, Mobile Marketing,Blogger, Youtuber etc. are some of the areas of career making and development.**

Keywords:Career making,development,digital skills,SEO,SEM.

Introduction

Our everyday lives have been tremendously affected by online world. Without technology and online communication we cannot imagine our lives. New technologies opened up so many opportunities. Digital marketing is the fastest growing sector in Asian Continent and in India. Every year digital marketing is producing many career options. Now a days businesses are not restricted to infrastructure and location. There is no need to migrate to big cities to do business and grow. Qualified employees, opportunities to create network and partnerships are no hurdle now. For career making and development only computer and the internet connection becomes the basic requirement and in the race of competition, data is available at the cheapest rate.

Marketing is based on what the customer is using.If we go back in history we found that first of all customer uses Radio and that was the starting of radio advertising and marketing. After that television is the most widely and globally used device which allowed companies to reach mass with ads.Even now television advertising is one of the most used advertising strategies for companies.Major part of expenditure is born by companies on advertisement. With the advancement of technology there is a boom in internet user, which gave birth to new era of marketing originally called as Internet Marketing also called as Digital Marketing.

Digital marketing is a marketing method to promote products in online. So in simple terms, we can say that we are promoting our products to customers who are using the internet. Many concepts of traditional marketing are applicable to digital marketing.

Determinants on Digital Marketing

Flexibility

Unlike other job digital marketing provides flexibility. If you are having internet connection than this becomes the most promising job.There is no compulsion to work according to office hours of 9 to 5, doesn't matter whether you are working from home, office or any other location, unless you have good network connectivity. There are numbers of companies, who want to outsource their digital marketing project. Resolving their issues anytime can add valuable bucks in your pocket.

Make Career Anytime

There is no need of any professional degree to earn.If you are having digital skills and device with network connectivity, digital marketing provides job opportunities without joining any company you can work as a bloggers, freelancer through online projects.

Make Money Online

Digital Marketing professionals can take the advantage of their and use his skill set to generate income. With Google AdSense,Bloggs,Reviews Affiliate Marketing and Freelancing, person can able to earn a good income. Part-timers and full-timers both can earn through online.

Handsome Salary

SMO, SEO.SME Bloggers full –stake developers and other profile of digital marketing can earn a handsome salaries. IT companies offers minimum 10-15 lakhs and to experienced upto 40 lakhs.

A fresher can expect between Rs 20000-30000 rupees per month.

Literature Review

Payal Chaudhari in her research paper "Role of digitization and E- commerce in Indian Growth : An Employment Generation Perspective" compare India with western countries and concluded that internet is expected to contribute 4.6% in Indian GDP and also SME sector will grow . Digitization in India will increase output and create jobs.She suggested effective planning and regulation of digitization to help Indian economy to compete with developed nations.

Rani A sandhya, Srikanth Uma and Trivikram in there research paper " A study on future and scope of digital marketing" explains digital marketing trend in India , trends for organisations, scope in India and for entrepreneurs, benefits of online marketing over offline marketing.

Emerick, Eder and Darter Making use of the information based advantages of the Web is one major transactional area. Companies can communicate continuously with their business partners and consumers, get and disseminate information, and solve business problems immediately and effectively through the use of advanced information technologies; thus exchanging sectoral information so easily becomes an important source of efficiency for any online company

Reddy in his paper A study on "Electronic Marketing in India: A Study on Opportunities and Challenges" concluded that the major factors attributing to the imminent success of e-marketing are, the high level of interactivity, the 24 hours/7days/365(a year) functionality, and the unconfined boundaries. However, there are certain hurdles to overcome before e-marketing becomes a viable business model in India. First and foremost is building trust and loyalty, rather than promoting it as a cost effective option. People go to a dot.com for convenience, comfort, trust, safety and savings. With the gaining prominence of e-marketing – management and execution of strategic marketing programs for customer acquisition, customer retention and cross selling will come into play. This will require a tactically defined and developed eCRM strategy, to optimize consumer buying habits and increase the net conversion ratio of 'prospects' to 'advocates'. It is believed that the intrinsic strength of the medium and its unique advantage will make e-marketing a big reality in India very soon.

Objectives

> ➤ The main objective of the research paper is to find various career opportunies in the field of digital marketing.
> ➤ To know further various career enhancement and development activities through digital marketing.

Methodology: The present study os based on secondary facts and figures collected from various published e-sources and publications in newspaper,magazines,reports etc.

Career Opportunities

The digital marketing provides various career opportunities to marketers, consumers through social media,online,and mobile marketing activities and programs.One of the special form of online marketing that places communications on cell phones , smart phones of consumers or tablets of consumers.According to researchtill 2020 more than 1.5 lakh jobs are expected to be created in the area of digital marketing. The requirement of skilled professionals and jobs will increase further due to higher usage of Digital Marketing & advertising by brands and SME's.

The main area of online communication and marketing are websites, display ads, search ads, emails, blogs,mobile marketing, and social media.As per the statistics on internetlivestats around 46% of the world population has internet connection today. Region – wise Asia is in top position

using internet. America , Europe, Africa are in the line next.The top five countries using internet as per rank are China, India, U.S. Brazil, Japan .(2016 internet uses data- WorldBank Group) Due to the increase in number of internet users, digital marketing is also showing rapid growth as compared to the traditional ways.Now a days businesses use social media to select age, location,gender, range and interests of there targeted group.On the basis of recent search history of customer on internet , they see advertisements from similar brands, products and services, which help businesses to target the specific customers.

The presence of Digitalisation can be seen in all sectors and areas such as banking, insurance, telecommunication,manufacturing , education etc.

The best and simple way to start career in digital marketing is to find a job.Digital marketing offers profusion of career opportunities in different areras.This includes:

➢ **Digital marketing strategist** A Digital Marketing Strategist is responsible for developing solutions to meet clients' brand objectives based on consumer insight and data. Spotting trends and technologies that play roles in consumer's lives, as well as familiarity with SEM/SEO strategies are beneficial skills to have in this position. The Digital Marketing Specialist will also help cross-functional teams develop and evolve ideas to bring together brand goals, retailer objectives and consumer needs.

➢ **Digital marketing executive:** Companies are increasingly realising the importance of digital marketing in enhancing their business thus creating many new career paths and job titles. The ability to build an online connection to customers or clients is quickly becoming one of the most highly demanded skills in the job market.

A digital marketing executive is typically responsible for engaging a brand with customers or clients via the digital space, aiming to establish and manage the online presence. It is their job to keep up to date with relevant issues and latest news through articles and blogs to ensure that their brand is at the forefront of any industry developments

➢ **SEO analyst**- SEO stand for Search Engine Optimization. SEO is a strategy of getting website ranking on Google or other search engine.It is a process of optimizing website for increasing visibility on Google pageIt becomes important for a company to hire SEO professional as Google algorithms are dynamic in nature.

Future in SEO

SEO is a booming industry and SEO professionals are in great demand. This drastic change has happened because of marketers' awareness towards digital marketing. Instead of only a career option, SEO has emerged as a necessary skill which will shape your career towards digital marketing. So if you are zealous towards marketing, analytics, websites and knowing new skills, give wings to your career with SEO. The highlighting feature of this strategy is that you don't need high degree, if you have logic, dedication and patience you can do it!

The best part of SEO profile is that you can do part time, full time job or else you can be the owner of your company. If you are a fresher, start your career with Jr. SEO Executive, spend some time at this designation and then learn Advanced SEO for upgrading your skills. Gradually you can move to higher designation as SEO Executive, team leader or manager.

- ➢ **Search Engine Marketing (SEM):** To increase the visibility of webpages is through sponsored placements and advertising. SEM specialists should know how to run campaigns, how to purchase traffic through paid search listing to maximize visibility of web pages on search engines.

- ➢ **Social Media Marketing specialist** : Business without social media is not even an option. The effect this channel has on how information is received, perceived and shared is profound. So much so, that even if a business wants to stay out of social media, it just cannot bear the risk of losing all those customers who are present on it .With the usage of social media at an all-time high, successful businesses have shifted quite a chunk of their promotional load to online platforms that are visited by thousands of users on a daily basis. No marketing and promotional strategy is now complete without a sizeable budget and room for social media marketing

SMM is only another form of search marketing that has been introduced ever since social media appeared. With a refreshing take on the latter, SMM has developed new ways to market the same products, using channels of communication that are visited by the audience more than any search engine website

Social media marketing is definitely a creative and out-of-the box alternative to physical and traditional marketing of a business

- ➢ **Become a Professional Blogger:** Many digital marketing professionals choose full time blogging as their career choice. With dedication and hard work, many professionals are not successful bloggers in their chosen niche. Bloggers can generate income with advertising & affiliate marketing strategies.

- ➢ **Email marketing specialist**: Email marketing is a widely used technique by companies and firms who want to reach out to their audience. It is a simple and highly effective technique, which is why it has become so very popular in the business world today. Research and statistics show that the number of people who use this method is increasing day by day, and that it is indeed one of the fastest growing techniques being used by online marketers.

Email marketing is basically the process of getting in touch with previous, existing as well as potential clients and customers via the modern facility of electronic mail, which is commonly referred to as email

Email marketing, is an internet based strategy that aims to build a bridge between companies and general public. It is a relatively new technique so to say, because it came into being after the advent of the internet and the World Wide Web. The strategy is heavily reliant upon carriers that allow people to send and receive electronic mail, which is typically called email.

➢ **Web Analyst**- The website is like a portal that opens up a range of possibilities for the users. There are a lot of different kinds of static and dynamic websites, which allow varying ranges of interaction and entertainment. Usually people do not realize that at the backend of their internet usage and browsing is being recorded in different statistical forms so that the website owner could know more about the visitors on the website.

This systematic approach to finding out more about users of your website is broadly known as web analytics. Web analytics basically refers to the usage of web data for analysis and understanding of online patterns. For web analytics, the data is collected, measured and then interpreted. Web traffic is gauged and measured by using different types of instruments. The number of people who visit a website and the type of activity they conduct while using that website is recorded consistently so that the website developers can analyze which aspects are interesting and which ones need to be modified. Web analytics is used to assess the effectiveness of the content placed online.

Through web analytics there is an attempt to gauge how the website content affects the users and how the users respond to different types of stimuli on the web page. Monitoring the users' activity and the site's performance are some of the most important functions of web analytics. In order to find out about the online activity of the users, their preferences and their tastes, web analytic tools are extensively used. Market research is another area where this data is extremely relevant.

Marketing, advertising and e-commerce are some of the areas where the reports from web analysts are used. Web analytics is of two types, off-site and on-site. There are four basic metric categories known as site usage, referrers, site content analysis and quality assurance.

These metrics are used to evaluate and record the performance of a website in order to create a comprehensive report focused on some of the following goals:

• Efficiency of website content • Site usability • Learning about the target audience • Quality traffic • Referrals • Conversion rate • Social reports • E-commerce reporting

➢ **Mobile Marketing:** Nowadays almost all people are using smartphones among all age groups. Mobile marketing provides instant updates, promo offers and information of customers' interests. Mobile apps can perform useful functions such as adding convenience, social value, incentives and entertainment.

➢ **Become a YouTuber:** Person can choose to become a full-time YouTuber in a selected niche. Person need to focus on the quality of content and building your audience base in YouTube. Once he start getting subscribers and views, you can make a money with YouTube monetization

Discussion and Analysis

Indian Context

As per the report total contribution by digital segment in Job availability in the year 2017 was maximum in Banking & Finance sector by 44%,e-commerce, healthcare and others contribute 12% each and media,telecom,utility contribute 6% each in India.

Contribution of Digital Marketing in Various Sector
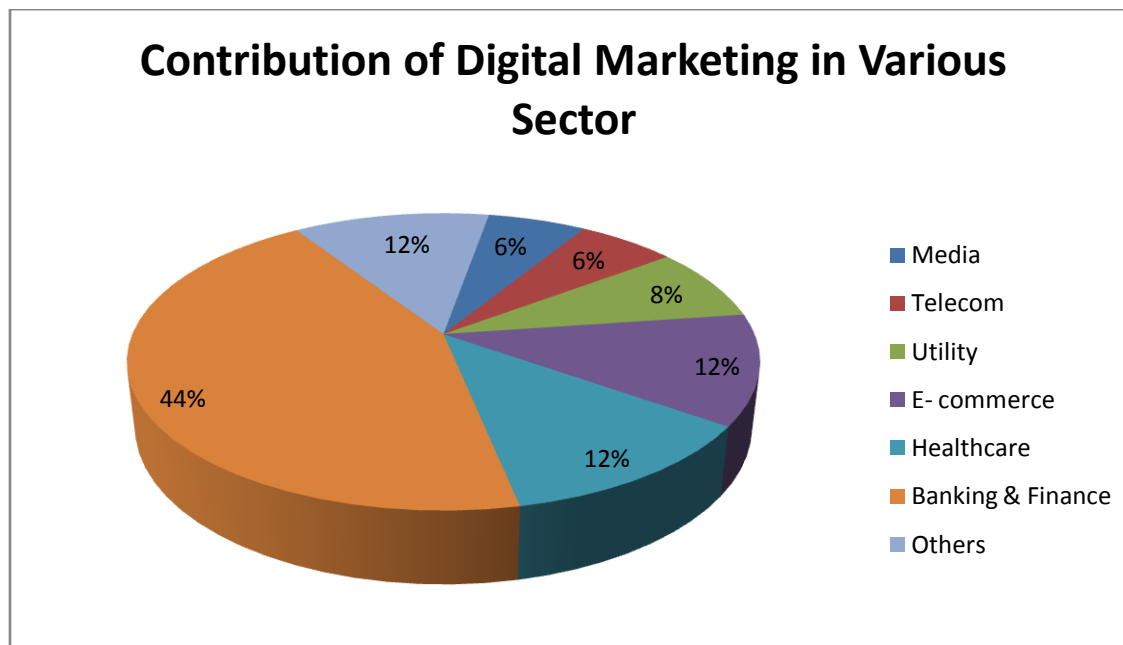
Source: great learning.

As per the report after 5 year 9% job will be such which is not now, 37% job will be with better skills. Sectorwise analysis of digitalisation

Sectors	Present workforce increase	Workforce in 2022	New Skill	After 5 years
IT	6-6.5%	45 Lakhs	70-75%	3-3.5%
Banking	4-4.55	20 Lakhs	70-75%	3.5-4%
Automobile	3-3.5%	1.43 Crores	60-65%	2-2.5%
Textile	9-9.5%	4.07 Crores	45-55%	8-8.5%
Retail	2-2.5%	2.2 Crores	25-35%	0.5-1%

Source: NASCOM,FICCI and EY report

The table indicate that in the year 2022 IT sector will be having 45 lakhs workforce out of which 70-75% requires new skills.Now the total workforce is increasing 6-6.5% rate every year, which will be 3-3.5% after 5 years.

In case of Banking sector in the year 2022 total workforce will be around 20 lakhs out of which 70-75% requires new skills.Now the total workforce is increasing 4-4.5% rate every year, which will be 3.5-4 % after 5 years.

In case of Automobile sector in the year 2022 total workforce will be around 1.43 crore out of which 60-65% requires new skills.Now the total workforce is increasing 3-3.5% rate every year, which will be 2-2.5 % after 5 years.

In case of Textile sector in the year 2022 total workforce will be around 4.07 crore out of which 45-55% requires new skills.Now the total workforce is increasing 9-9.5% rate every year, which will be 8-8.5 % after 5 years.

In case of Retail sector in the year 2022 total workforce will be around 2.2 crore out of which 25-35% requires new skills.Now the total workforce is increasing 2-2.5% rate every year, which will be 0.5-1 % after 5 years.

Conclusion

Digitals Contribution in revenue of company double in the past three years. As per the report of 1610 companies and according to the care ratings report, in the year 2017-18 job growth was 3.8%. 13% growth was seen in financial services and retail sector,10.3% in auto, 9.1% in healthcare, 9% in construction and infrastructure and 4.8% in IT.There was a decline of 7.6 % in telecom. As per Linkden machine learning engineering, app development analyst, back –ad developer, full stake developer and data scientist are the five segments where jobs are increasing. Now around 50000 posts are vacant in data science due to non availibilty of skilled people

Digital marketing is a fiercely competitive battlefield. While there is a need to have the genuine and powerful information, it is equally good to know how the digital marketing works well. Timely insights and the right kinds of analytics can be combined for the sake of getting better outcomes of digital marketing. As the digital buyer penetration in India is projected to increase to 70.7% in 2020, the future belongs to digital marketing. Websites, Social media, blogs, and e-newsletters would dominate techniques for sharing content by the marketers. As the brands realise that customers' feedback, comments and content are extremely valuable and huge job opportunities would emerge for those who are net savvy.

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AROMATIC LIQUID HYDROCARBON FUEL (ALHF) PRODUCTION FROM THE WASTE PLASTICS USING PYROLYTIC REACTOR UNDER THERMAL DEGRADATION

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ABSTRACT

Plastic waste pollution is a major environmental issue in day to day life since plastic waste could not be biodegradable. However, the plastic wastes can be recycled by the way of different methods such as primary recycling (re-extrusion), secondary recycling (mechanical recycling), tertiary recycling (chemical recycling) and quaternary recycling (burning / incineration - not use in India). Chemical recycling method also known as pyrolysis or thermolysis is one of the most efficient methods is converting waste plastic into renewable energy. Thus this investigation deals with the minimization of a huge heap of the waste plastic generation into alternative aromatic liquid hydrocarbon fuel (ALHF) which has greater demand in the replacement of crude oil sector throughout the world. Various types of waste plastics such as Low -Density Polyethylene (LDPE), High -Density Polyethylene (HDPE), Polypropylene (PP) and Polystyrene (PS) into alternative aromatic liquid hydrocarbon fuel (ALHF) were chosen for this study. The experiment was carried out in the prototype pyrolytic batch reactor powered by an electrical heating source without using the catalyst. TGA analysis was carried out to fix the range of operating temperature for the were process which reveals in the range of 318.50ºC-485.30ºC. Physical properties were determined by the ASTM / APHA methods such as density, kinematic viscosity and gross calorific value (GCV) which revealed in the range of 0.781-0.792 g/cc, 1.78-1.81cst and 9171-10761 kCal/Kg respectively are similar to conventional petroleum diesel fuel (ie., density – 0.815 – 0.870 g/cc, kinematic viscosity – 2.0 – 5.0 cst and gross calorific value (GCV) –10,282.7 kCal / Kg). FTIR analysis was carried out for ALHF which reveals the functional groups such as paraffin's, olefins and naphthenes were found and the same is similar to the literature reports. The yield percentage of the ALHF was estimated and found to be high in PS (81.6%) and low in LDPE (58.07 %) at the optimum temperature of 450ºC and the reaction time of 90 minutes. Thus the product of ALHF can be used as one of the possible alternative renewable energy sources for electricity generation and it may suitable as a transport fuel with the upgrading of different post-treatment such as refining and blending with conventional diesel is required as per the presence of carbon chain.

Key Words: Waste Plastics, Recycling, Pyrolysis, ALHF, Renewable Energy.

Introduction:

Plastics are tough, light-weight and decrepit materials which will quickly be formed into a different thing that recognize uses in an exceedingly wide plan of employment. Likewise, the social affair and livelihoods of plastics have expanded in recent decades. Reliably, a huge hundred million tons of plastics are produced over the world. According to the CPCB – CIPET overview led at sixty Indian urban zones, the essential per capita usage of plastic in India is concerning eleven kilos, which is fundamentally low when contrasted with the overall normal of twenty -eight kilos. This can be any conveyed into perspective with an exceptional load on the US wherever use is somewhat on various occasions. The Ministry of Petroleum and Natural Gas, Government of India recommends that the yearly per capita utilization in India would be twenty kilos by 2022. Further, the amount of plastic manufacturing and utilization would altogether increase which have related to the emissions of greenhouse gases (GHG) by 2050 (Shailaja et al, 2018).

As indicated by the CPCB reports, eight percent of the plastics are mixed in the entire solid waste, with an urban centre like Delhi generating the highest volume after by city Kolkata and Ahmedabad. At this moment, plastic wastes address concerning the third most astonishing degree in MSW when sustenance and paper wastes in numerous urban networks (UNEP, 2009). Plastic carry bags could be a noteworthy environment and public health issues in India, particularly in urban regions (Tammemagi, 1999). Plastic bags of all sizes and thickness are often found occupying the city landscape due to problems of overuse and littering in India (Kaushal et al., 2014). Moreover, plastic bags tend to clog drains, gutters, and rainwater vents, thereby creating a flood-like scenario even for sparse rains. Further, they also pose a danger to stray animals, such as cattle and dogs, who stand a good chance of consuming them. Waste plastics are now a major stream in municipal solid waste (MSW) due to their increased production and usage.

The issue of plastic waste is particularly genuine in developing urban areas in view of the absence of incorporated strong waste administration including their unmistakable arrangement of financial, across the board money related condition, and ecological foul play. The majority of the produced waste plastics neither gathered nor legitimately discarded incurring littering and gagging of drains. The matter of sea plastic litter is on the rise in view of the flooding effect of plastic waste into the sea. It has been accounted for that in India, 0.60 million tons of plastic waste, out of 5.6 million tons, end up in oceans every year. The seas close city Mumbai, Kerala, and Andaman and the Nicobar Islands are among the most polluted in the world [down-to-earth, 2018]. Plastic wastes and micro-plastics could be entered into the marine environment from the land by rivers, drainage or sewage systems, or by wind transport. Some of the most important land-based sources of larger plastic (macro plastics) wastes are from construction, household goods, packaging, coastal tourism along with food and drink packaging.

One time use and throw away plastics are those that are designed to be used only once before being thrown away, which includes light-weight plastic bags, disposable utensils, coffee cups and stirrers, soda and water bottles, food packaging, and so on. Around 43% of manufactured plastics are used for packaging purpose and most of these are single use in India.

These materials are not properly discarded which leads to contaminants the water bodies over a prolonged period of time. Drinking water bottles are generally the most common sources of toxicity due to leaching of phthalates and bisphenol A (BPA) and Phthalates have been found to deposit in the fatty tissues of the human body, where they act as antiandrogens. Investigations suggest that this leads to diseases and health problems, such as male reproductive dysfunction, breast growth, and testicular cancers (Jobling et al., 1995). The BPA is known for its harmful effects on human placental tissues. Investigators have found that the BPA even causes premature birth, intrauterine growth retardation, and stillbirth (Benachour and Aris, 2009).

At present, plastic waste is widely incinerated and landfilled or openly dumped. These methods of plastic waste management have negative effects. This is because the former produce several pollutants that are harmful to the environment and the latter has the danger of leaching and soil impregnation, leading to the contamination of underground waters (Pinto et al., 1999). The clogging effects and the slow biodegradable nature of plastics with toxic additives and dyes are an added environmental burden through landfills and landfill operation (Miandad et al., 2016a).

Globally, different types of plastic waste management techniques are followed such as reducing, reusing, waste to energy, mechanical and chemical recycling and landfilling (Sriningsih et al., 2014 &Sadef et al., 2015). Sorting, grinding, washing and extrusion can recycle only 15–20% of all plastic waste by the way Mechanical Recycling method (Ashworth et al., 2014). Chemical recycling of plastic waste through hydrolysis, methanolysis, and glycolysis along with waste to energy (WTE) technologies such as gasification, pyrolysis, refuse-derived fuel (RDF) and plasma arc gasification are the most preferable methods and subject of the same are the more scientific attention in recent decades(Sadef et al., 2015&Sinha et al., 2010).

The pyrolysis process converts organic materials including plastic waste into energy (liquid oil) and value-added product (char) (Bartoli et al., 2015 &Rathore et al., 2016). The process can be carried out by using different types of reactor such as tube reactor (Miskolczi et al., 2009), rotary kiln reactor [24], microwave reactor (Undri et al., 2013), fixed bed reactor (Ringer et al., 2006), semi-batch reactor (Lopez et al., 2011), and batch reactor (Syamsiro et al., 2014), Batch and semi-batch reactors are widely used at laboratory scale due to their easy operation, simple design, and safety point of view (Almeida and Marques, 2016, Chen et al., 2014 &Ates et al., 2013).

Recycling is a possible path for plastic waste disposal. However, the plastic wastes can be recycled by the way of different methods such as primary recycling (re-extrusion), secondary recycling (mechanical recycling), tertiary recycling (chemical recycling) and quaternary recycling (burning / incineration - not use in India). Chemical recycling method also known as pyrolysis or thermolysis is one of the most efficient methods is converting waste plastic into renewable energy. Most of the recycling processes are costly, energy intensive and end up producing low-grade products. Pyrolysis is a very viable and sustainable waste management process in the treatment of municipal solid waste containing carbonaceous materials like plastics and biomass (Xue et al., 2016).

The pyrolysis is a process of the thermal decomposition of materials at elevated temperatures in an inert atmosphere and it involves the change of chemical composition and is irreversible. The term pyrolysis (Pyro = heat, lysis = breakdown into parts) is a chemical reaction in which large molecules are broken down into smaller molecules. Pyrolysis may also be called as thermal cracking, cracking, thermolysis, depolymerization, etc. The simplest example of pyrolysis is cooking in which complex food molecules are broken down into smaller and easily digestible molecules. It is an industrial process to breaking down large molecules of plastic into smaller molecules of liquid pyro oil, pyro gas and carbon black which takes places at about 350-450ºC and no presence of oxygen. The plastic will start burning in case the oxygen is present. The end products of the plastic pyrolysis are also like hydrocarbons.

In the particular case of renewable energy and the decrease of fossil resources, plastic waste recycling was the topic of several researchers from all over the world in the last several years (Al-Salem et al., 2009 &Panda et al., 2010). It is well-known that low and high-density polyethylene, polypropylene and Polystyrene are the main plastics in municipal solid waste around the world. Several reports have been published on different ways for chemical or petrochemical feedstock recycling of PE and PP, because it results in hydrocarbon products like fuel after pyrolysis (Berrueco et al., 2012&Della Zassa et al., 2010). Many reviews or books on the technology or current trends in pyrolysis of polyolefins to fuels can be found in recent years (Butle et al., 2011).

Thus, this paper deals with the thermal degradation of different types of waste plastics such as Low Density Polyethylene (LDPE), High Density Polyethylene (HDPE), Polypropylene (PP) and Polystyrene (PS) in a pyrolytic batch reactor have been investigated on the yield and quality of Aromatic Liquid Hydrocarbon Fuel (ALHF). It has been deemed significant in addressing the increasing problem of MSW disposal. The volume of plastic that will be incinerated and deposited in the landfill or dumpsite will be minimized thereby reducing the carbon emission and carbon sink in the environment.

Materials and Methods:

 a) Feed Stock Preparation:

Waste plastics such as LDPE, HDPE, PP and PS were used in this work. Waste plastics were collected from the municipal solid waste dumping yard at Tiruvannamalai, Tamil Nadu. The waste plastics are segregated/sorted out as per the types: PE, PP, PS, PET, Vinyl and other as per the codes 1-7 mentioned in the BIS guidelines (IS: 14534:1998). The segregated/sorted plastic waste is then washed to remove glue, paper labels, dirt and any remnants of the product originally contained in the plastic by using the detergent powder. The sorted and or segregated plastics were cut into small pieces and shredded by using shredding machine which into small chips in the size about 1 cm^2 ready to be melted down.

 The Fig. 1(a) & (b) and 2(a),(b),(c) & (d) shows the PSW dumping along with the municipal solid waste in the MSW site and the different types of segregated plastic waste after shredding, respectively.

1(a)   *1(b)*

Fig-1 (a) & (b): Picture showing the PSW dumping in the MSW site in Tiruvannamalai Municipality, Tamilnadu, India.

2(a)   *2(b)*

2(c)   *2(d)*
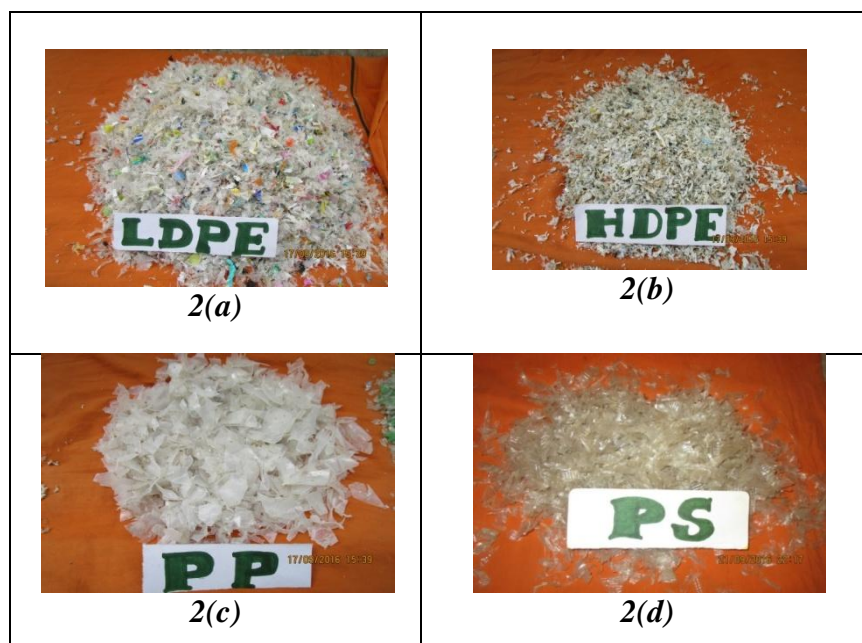
Fig-2(a), (b), (c) & (d): Picture showing the different types of segregated plastic waste after shredding.

b) Reactor Start-Up:

A small prototype pyrolytic batch reactor powered by an electrical heating source without using the catalyst was commissioned and used for the conversion of plastic waste into liquid oil (ALHF). The reactor has one kilogram capacity with electric power supply, which allows a maximum temperature of 600 °C. A glass made condenser with a water cooling setup is installed at the top of the reactor. Organic vapours produced in the heating chamber were condensed into liquid oil.   The condensed organic vapours were collected at the bottom of the system, while the uncondensed products in the form of gases coming from the same liquid oil pipe were exhausted from the reactor (Fig. 3).
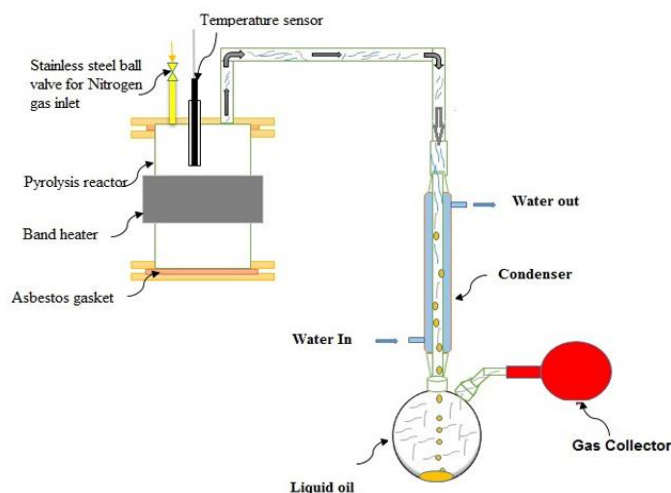
Fig-(3): Picture showing the Process Set up of Pyrolysis Reactor.

c) **Experimental Setup:**

In all of the experiments, 250 g of feedstock was used. The heating chamber of the pyrolysis reactor was heated at a rate of 10°C per min to achieve the set temperature. The experiment started by loading the sample to the reactor tank, setting the temperature controller to 450°C and turning on the electric heater. Each experiment lasted for 90 minutes per trial to totally dry the char inside the reactor, with the vapor residence time of 1 minute and vapor evacuation time of 1 minute. The feedstock was converted into organic vapours, which were condensed into liquid oil after passing through the condenser and collected in the collection tank at the bottom. The temperature of the condenser chamber was kept below 10°C to achieve the maximum condensation of organic vapours. The reaction time of each experiment was counted from the first drop of liquid oil produced. The residue (char) at the end of each experiment was collected from the heating chamber after allowing the system to cool down to room temperature. Subsequently, the liquid oil and char products obtained from the pyrolysis were measured at the end of each trial. After finishing each experiment, a mass balance of pyrolysis products was established through weighing of liquid oil and char quantities by using a standard digital balance and the remaining weight percentage to make up to 100% was all assumed to be the gas product.

d) **Analytical Methods:**

The elemental composition present in the feedstock (Waste Plastic) and the physical properties of process products (Liquid Oil) were characterized by using the Elementar Vario EL III analyzer (CHNS Mode), ASTM and APHA standard method, respectively.

For pour points, fire points and flash points, ASTM - D 97 tester was used with a temperature of -10 °C for one tank (left tank) and the temperature of 56°C for another tank (right tank). The sample was poured in the sample tube up to the mark. The sample was first put in the left tank until the temperature reduces to 0°C and then transferred to the tank on the right side.

The sample tube was taken out periodically from the tank after every 2°C decrease in temperature to observe the flow by holding the tube horizontally for 4S. This process was continued until the pour point and freezing point was reached.

For density measurement, a portable density meter ASTM D: 1298 – 99 (Reapproved 2005) was used, which was first calibrated with distilled water and then rinsed with acetone and allowed to dry between each sample, before taking the next measurements.

For Kinematic Viscosity measurement ASTM D 445-2006 method was used to measure the Kinematic viscosities of the liquid oil with 40 mm parallel plate's geometry. A small amount of the liquid oil sample was placed on the bottom horizontal plate. The upper 40 mm plate was lowered at a controlled rate so that the sample was sandwiched between the two plates. The temperature was set to 50°C and the shear rate range was set between 1 and 500 l/s. The rheometer was first calibrated using viscosity standard liquid followed by actual liquid viscosity measurements.

Gross Calorific Value (GCV), Cloud Point and pH of produced liquid oil were used to assess with the help of ASTM - D 4809, 2510 APHA 21st EDI 2005 and 2110 APHA 22nd EDN 2012 methods, respectively.

Thermo Gravimetric Analysis (TGA) of each plastic wastes were carried out by a Universal V4.7A TGA (SDQ600) to assess the optimum process temperature and reaction time by following the feedstock's thermal behaviour under control conditions. TGA analysis was carried out using l g sample poured into an aluminium oxide crucible, and heated at a rate of 10°C per min from 25 to 900°C under nitrogen flow at a constant rate of 10 ml/min.

Fourier Transform Infrared Spectroscopy (FTIR) used for raw sample analysis and liquid fuel oil sample analysis. The raw waste plastic sample analyzed with the help of diamond crystal plate KRS 5 check there functional group and band energy value. The liquid fuel oil sample was analyzed by NaCl cell 0.025 mm thickness. Both samples analysis by the same parameter used such as scan number was 32, resolution 4 and the range   4000-450 cm-1.

Results and Discussion:

  a) **Results of TGA pre-analysis:**

Pre-analysis of raw waste plastic by using TGA was carried out to find out optimum onset temperature and for completing the thermal degradation results from LDPE, HDPE, PP and PS are tabulated in Table-1 and showing in Fig- 4(a), (b), (c) & (d).

The thermal degradation of PP started at 364.4°C, reaching to 50% weight loss (T50) took place about 335°C and 95% degradation was completed at around 470°C for the heating rate of 10°C / min. Similarly, the PS showed one step thermal degradation trend, started at the minimum temperature at 318.5°C and was completed at 410°C for the heating rate of 10°C / min. The degradation temperature at which a weight loss of 50% (T50) takes place was about 390°C.

However, LDPE and HDPE showed two steps degradation which includes first starting from around 86.2 °C up to 355°Cachieving only 12 % degradation and 89.9°C up to 360°C achieving only 13.2% degradation, respectively.

Table-1
Thermal Degradation started and completed temperature obtained from TGA Analysis.

S.No	Types of Waste Plastics	Degradation Started at Temperature in (ºC)	Middle Degradation at Temperature in (ºC)	Degradation Completed at Temperature in (ºC)
1	LDPE	86.2	372.0	460.0
2	HDPE	89.9	376.4	483.4
3	PP	364.4	--	485.3
4	PS	318.5	--	410.0
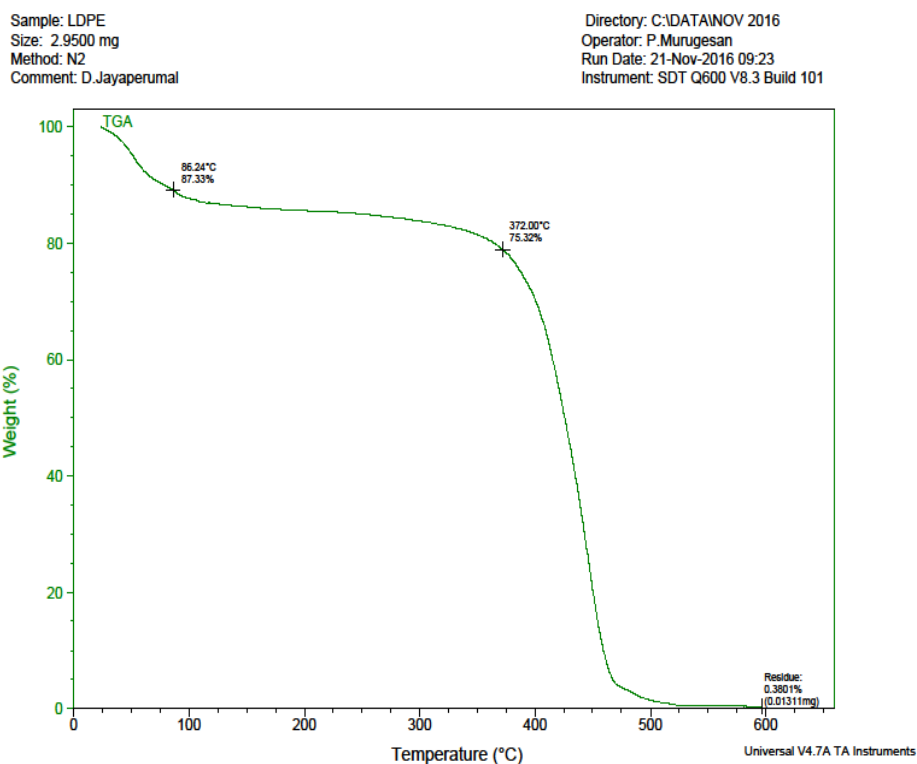
Fig-4(a): Figure showing Thermal Degradation starting and completing Temperature obtained from TGA Analysis of waste LDPE.

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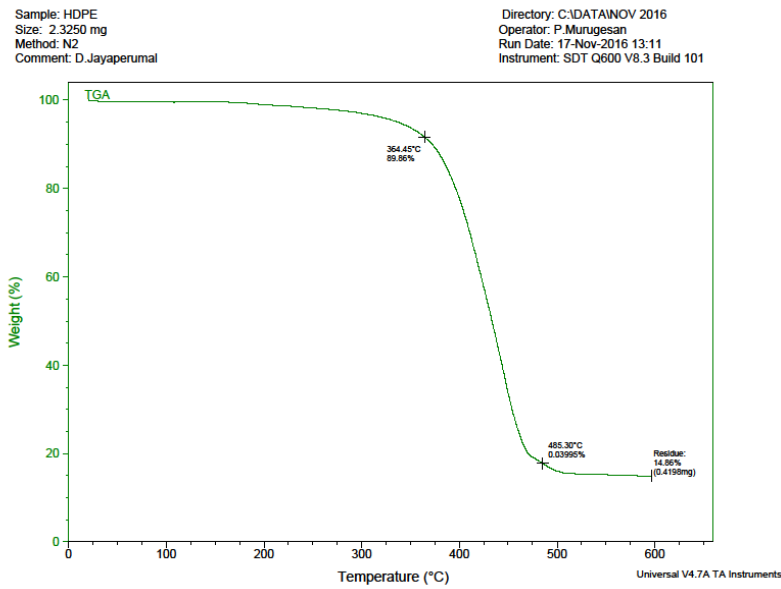
Fig-4(b): Figure showing Thermal Degradation starting and completing Temperature obtained from TGA Analysis from waste HDPE.
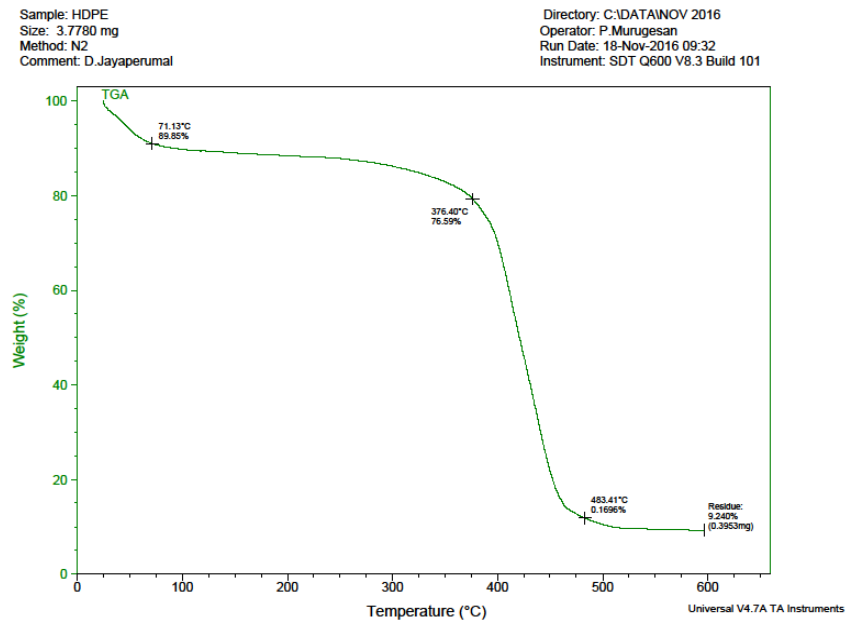
Fig-4(c): Figure showing Thermal Degradation starting and completing Temperature obtained from TGA Analysis from waste PP.
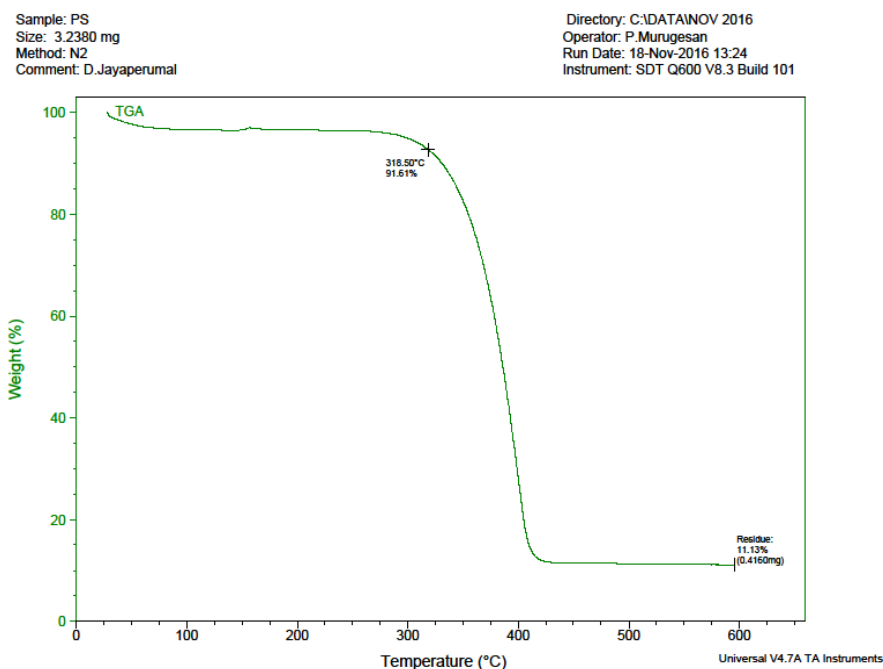
Fig-4(d): Figure showing Thermal Degradation starting and completing Temperature obtained from TGA Analysis from waste PS.

Then, the second step degradation was started at 372°C, reaching to 50% degradation at around 420°C for LDPE and up to 95% degradation at around 460°C, whereas the second step degradation was started at 376.4°C for HDPE, reaching 50% degradation at around 425°C and up to 95% degradation at around 483°C. It was interesting to note that 50 % of degradation for both feed samples such as LDPE, HDPE, PP and PS was achieved at around within 425°C. The difference in thermal degradation steps between PE (LDPE and HDPE), PP and PS could possibly to attribute the presence of some impurities and added additives together with its relatively complex, low, liner and high molecular structure.

A similar study has been done with thermal stability/degradation of waste HDPE in various ranges of temperature and reported that the waste HDPE degradation started at 390°C and was complete at 490°C for a heating rate of 20°C /min. the degradation temperature at which a weight loss of 50% (T_{50}) takes place was about 440°C for waste HDPE(Sachin Kumar et al., 2011). A similar trend was also reported during HDPE decomposition by TGA/DTG (Aboulkaset al., 2008). (Miandad et al.,2016) was also carried out the above these plastic waste individually such as PE, PP and PS to find out its optimum temperature for thermal degradation under control condition and reported that the thermal degradation of PP and PS started at around

240 °C and 330°C, reaching 50% degradation at around 350°C and 430 °C, up to 95% degradation at around 425°C and 470 °C, respectively. However, PE showed two-step degradation; first starting from around 270 °C up to 365 °C achieving only 12% degradation and then the second step was started at around 385 °C, reaching 50% degradation at around 430 °C and up to 95% degradation at around 510 °C. The addition of PP to HDPE has been reported to improve the liquid yield during the degradation in supercritical acetone at 450°C to 470°C, and 60 atm to 100 atm(Hwang et al., 2001). In the case of catalytic decomposition, a reduction of 20°C when LDPE, PP and PS were present along with HDPE(Lee et al., 2003).

b) Ultimate and Proximate Analysis:

CHNS Mode analysis results of percentage elemental composition such as Carbon, Hydrogen, Nitrogen and Sulphur from raw waste LDPE, HDPE, PP and PS are shown in Table - 2.

From the table- 2, it was observed from the present study that the elemental analysis composition having the major part of percent carbon and percent hydrogen up to the value of 80.82-85.41 and 12.98-14.05, respectively (such as PP< HDPE< LDPE< PS and HDPE< LDPE< PS< 14.05). Verification of the existence of hydrocarbon in raw waste plastics can be determined from the H/C ratio. The H/C ratio also indicates the level of saturation in the carbon-carbon bonds.

In pyrolysis of oil, the decrease of H/C ratio was observed which suggested that the dehydration and aromatization had occurred to form compounds containing carbon-carbon double bonds [49]. The same ranges of elemental analysis were reported with HDPE(Sachin Kumar et al., 2011), (Abulkas et al., 2008) and (Parkh et al.,2002) and also reported that the same percent range value of C, H, N with LDPE, HDPE and PP (MoidumSarkar et al., (2012).

From the Table-2 it was shown that PP has the highest H/C ratio, which LDPE shows lowest H/C ratio. The same trends were reported that PP has the highest H/C ratio where, PS shows the lowest H/C ratio(NatachaPhetyis et al., 2018).

Table-2
Elemental composition percentage such as Carbon, Hydrogen, Nitrogen and Sulphur from raw waste LDPE, HDPE, PP and PS.

Proximate Analysis								
Properties	Present Study				Waste HDPE (Sachin Kumar et al., 2011)	HDPE (Parikh et al., 2009)	Mixed Plastic (Kim et al., 2010)	HDPE (A. Aboulkas et al., 2012)
	LDPE	HDPE	PP	PS				
Moisture Content	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.00

Volatile Matter	100	100	100	100	100	100	92.90	99.4
Fixed Carbon	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.00
Ash Content	0.00	0.00	0.00	0.00	0.00	0.00	4.59	0.60

Ultimate Analysis

Elemental Composition in %	Present Study				Waste HDPE (Sachin Kumar et al., 2011)	HDPE (Parikh et al., 2009)	Mixed Plastic (Kim et al., 2010)	HDPE (A. Aboulkas et al., 2012)	MoinuddinSarker et al., (2012)		
	LDPE	HDPE	PP	PS					LDPE	HDPE	PP
Carbon (C)	84.72	83.04	80.82	85.41	80.58	84.95	79.9	85.36	86.31	86.02	86.32
Hydrogen (H)	13.04	12.98	14.05	13.63	13.98	14.30	12.6	14.15	14.34	14.34	14.52
Nitrogen (N)	0.00	0.00	0.09	0.000	0.60	0.55	-	<0.3	0.06	0.03	0.01
Sulphur (S)	0.591	1.073	0.501	0.319	0.08	-	-	-	-	-	-
Oxygen (O) / Others	-	-	-	-	5.19	0.20	5.16	<0.2	-	-	-
Chlorine	-	-	-	-	-	-	1.13	-	-	-	-
Gross Calorific Value (GCV)	9426	9743	10782	10826	10934	-	10518	-	-	-	-

Further, it was reported that the volatile matter is 100% in the proximate analysis, due to the absence of ash in waste HDPE sample, its degradation occurs with minimal formation of residue(Sachin Kumar et al., 2011). The same range of value were obtained in the present study on the proximate analysis of the waste LDPE, HDPE, PP and PS samples.

c) FTIR Analysis:

FTIR analyses of raw plastic wastes such as LDPE, HDPE, PP and PS were performed and the functional groups appeared in the results are shown in Table: 3-6 and figures 5(a)-5(d).

Table-3
FTIR analysis obtained from raw LDPE waste plastic.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3609.69	O-H stretch/ Medium, sharp	Alcohol	1371.03	CH$_3$C-H Stretch/ Medium	Alkanes
2961.23	C-H stretch/ Medium	Alkanes	1304.03	C-F Stretch/ very strong	Alkyl halides
2727.02	C-H stretch/ Medium	Aldehyde	1162.70	C-F stretch/ very strong	Alkyl halides
2023.31	N=C=S stretch/ strong	Isothiocyanate	986.21	C=C bend/ strong	Alkene
1896.59	C-H bend/ weak	Aromatic compound	722.12	-(CH$_2$)$_n$ bend/ weak	Alkanes
1744.93	C=O stretch/ strong	Esters	606.77	C-Br stretch/ strong	Alkyl halides
1458.04	C-H bend/ strong	Alkanes	477.42	C-I stretch/ strong	Alkyl halides

Table-4
FTIR analysis obtained from raw HDPE waste plastic.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3607.09	O=H stretch/ Medium, sharp	Alcohols	1708.90	C-H bend/weak	Aromatic compound
3291.10	≡C-H bend/ strong, sharp	Alkynes	1637.22	C=Cstretch/ medium	Conjugated alkene
2944.62	C-H stretch/ strong	Alkanes	1460.65	C-H bend/ strong	Alkanes
2860.28	C-H stretch/ strong	Alkanes	1303.13	C-F Stretch/very strong	Alkyl halides
2662.61	O-H stretch/ strong, broad	Aldehyde	1078.39	C-O stretch/ Medium, sharp	Alcohols

2024.08	N=C=S stretch/ strong	Isothiocyanate	721.62	$-(CH_2)_n$ bend/ weak	Alkanes
1901.19	C-H bend/ weak	Aromatic compound			

Table-5
FTIR analysis obtained from raw PP waste plastic.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3649.21	O=H stretch/ Medium, sharp	Alcohols	1473.73	ringC=C stretch/ Medium, sharp	Aromatic compound
3438.08	O-H stretch/ Medium, sharp	Alcohols	1304.41	C-F Stretch/ very strong	Alkyl halides
2991.98	C-H stretch/ strong	Alkanes	1218.12	C-O stretch/ Medium, sharp	Alcohols
2878.76	C-H stretch/ strong	Alkanes	616.33	≡C-H bend/ strong, broad	Alkynes
1752.76	C=O stretch/ strong	Ketones	498.54	C-I stretch/ strong	Alkyl halides
1679.22	C=O stretch/ strong	Ketones			

Table-6
FTIR analysis obtained from raw PS waste plastic.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3645.41	O-H stretch/ Medium sharp	Alcohols	1598.62	N-H bend/ Medium sharp	Amides
3489.8	O-H	Alcohols	1305.35	C-F Stretch/	Alkyl

1	stretch/ Strong broad			very strong	halides
3441.36	O-H stretch/ Strong broad	Alcohols	1219.03	C-F Stretch/ very strong	Alkyl halides
2991.98	C-H stretch/ Strong	Alkanes	970.29	=C-H bend/ strong	Alkenes
2880.23	C-H stretch/ Strong	Alkanes	614.63	C-Br stretch/ strong	Alkyl halides
1755.73	C=O stretch/ strong	Ketones	495.24	C-I stretch/ strong	Alkyl halides
1677.79	C=O stretch/ strong	Ketones			
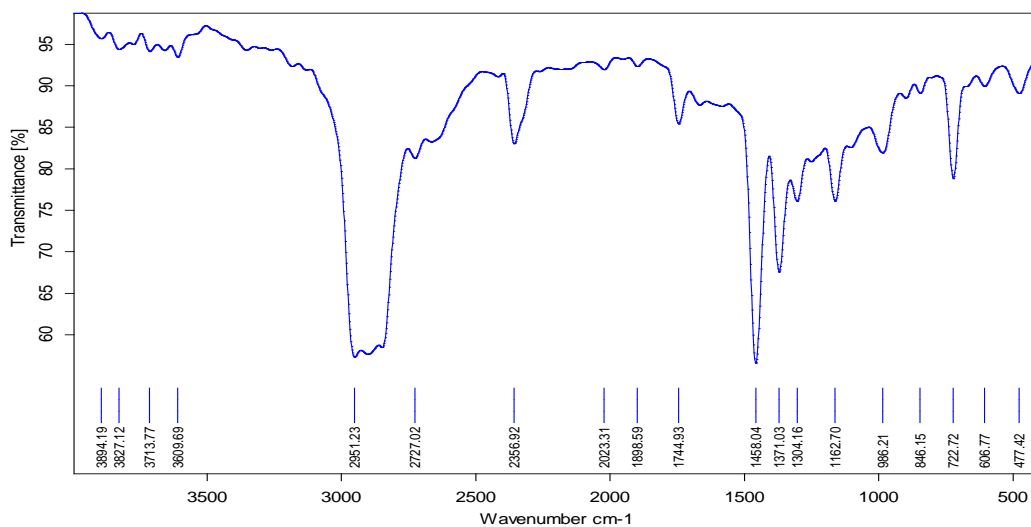
E:\Data FTIR\Jayaperumal\LDPE.0   LDPE   Instrument type and / or accessory   21/11/2016

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Figures 5(a): Figure shows the FTIR analysis obtained from LDPE waste plastics.
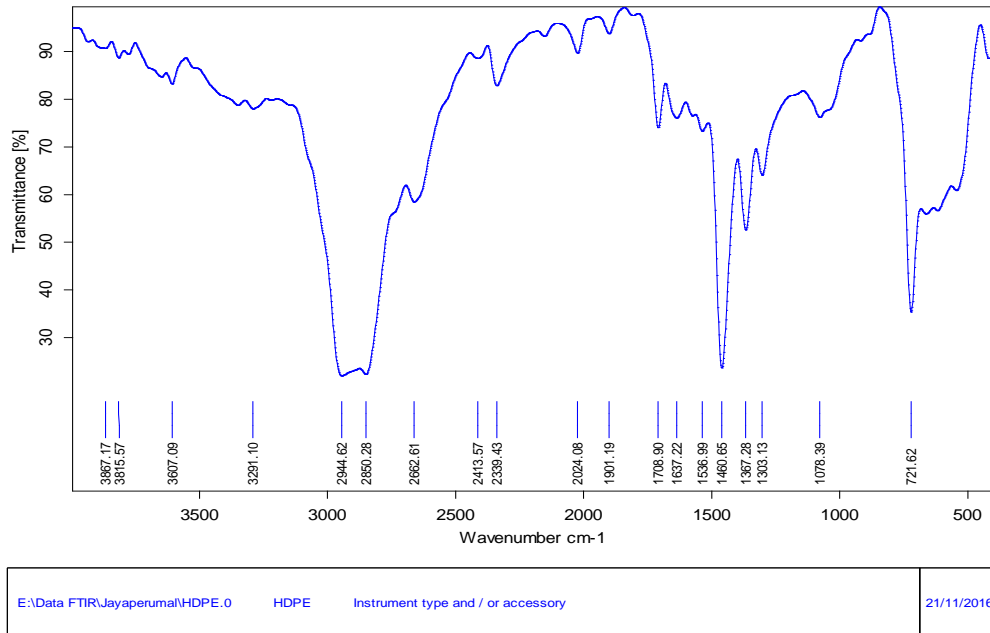
Figures 5(b): Figure shows the FTIR analysis obtained from HDPE waste plastics.
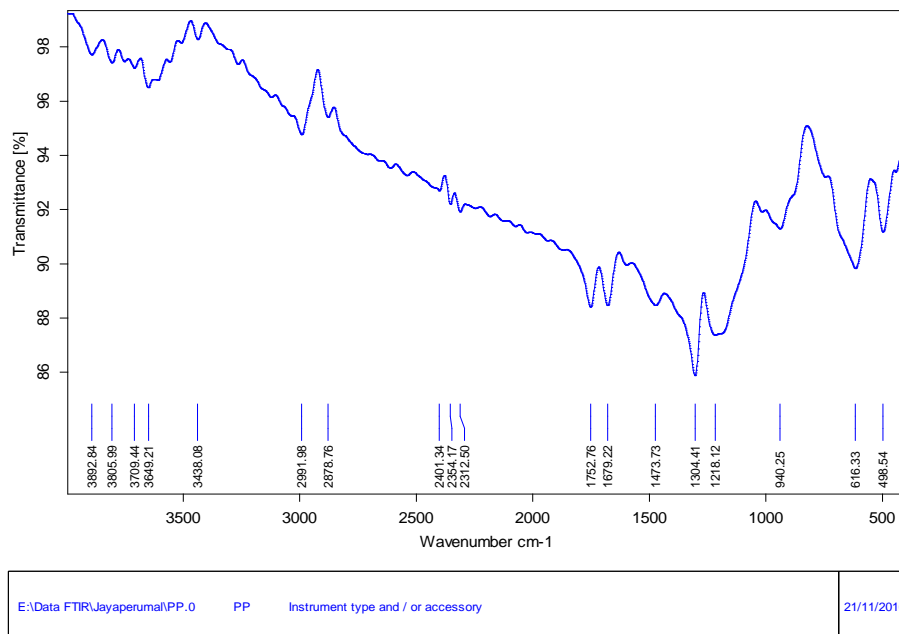
Figures 5(c): Figure shows the FTIR analysis obtained from PP waste plastics.

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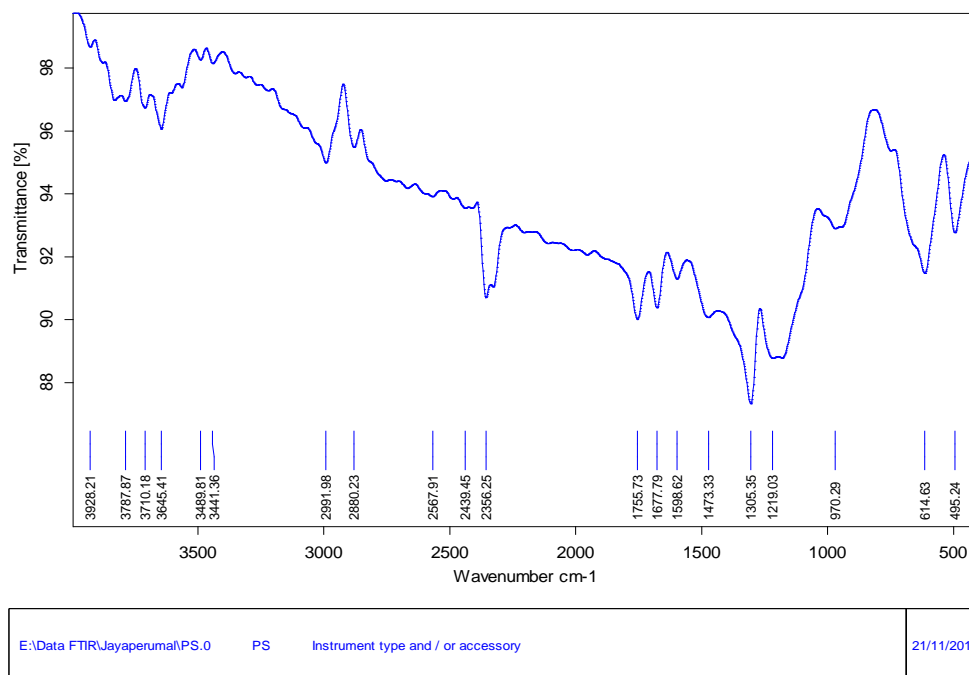
Figures 5 (d): Figure shows the FTIR analysis obtained from PS waste plastics.

From the FTIR results, the following functional types of groups appeared in the raw LDPE waste plastics such as wave number 2961.23cm-1 shows that the presence of alkanes functional group in medium appearance with respective to C-H stretch, wave number 2727.02cm-1 shows that the presence of aldehyde functional group in medium appearance with respective to C-H stretch, wave number 2023.31cm-1 shows that the presence of Isothiocynate functional group in strong appearance with respective to N=C=S stretch, wave number 1896.59cm-1 shows that the presence of aromatic compound functional group in weak appearance with respective to C-H bend, wave number 1744.93cm-1 shows that the presence of esters functional group in strong appearance with respective to C=O stretch, wave number 1371.03cm-1 shows that the presence of alkanes functional group in medium appearance with respective to CH3C-H Stretch, wave number 1304.03cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F Stretch, wave number 1162.70cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 986.21cm-1 shows that the presence of alkene functional group in strong appearance with respective to C=C bend, wave number 722.12cm-1 shows that the presence of alkanes functional group in weak appearance with respective to -(CH2)n bend, wave number 606.77cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-Br stretch and wave number 477.42cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-I stretch.

FTIR analysis of raw HDPE waste plastics, following types of functional groups are appeared such as wave number 3607.09cm-1 shows that the presence of alcohols functional group in medium sharp appearance with respective to O=H stretch, wave number 3291.10 cm-1 shows that the presence of Alkynes functional group in strong sharp appearance with respective to ≡C-H bend, wave number 2944.62cm-1 shows that the presence of Alkanes functional group in strong appearance with respective to C-H stretch, wave number 2860.28cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2662.61cm-1 shows that the presence of aldehyde functional group in strong broad appearance with respective to O-H stretch, wave number 2024.08cm-1 shows that the presence of Isothiocynate functional group in strong appearance with respective to N=C=S stretch, wave number 1901.19cm-1 shows that the presence of aromatic compound functional group in weak appearance with respective to C-H bend, wave number 1708.90cm-1 shows that the presence of aromatic compound functional group in weak appearance with respective to C-H bend, wave number 1637.22cm-1 shows that the presence of conjugated alkene functional group in strong appearance with respective to C=C bend, wave number 1460.65cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H bend, wave number 1303.13cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F Stretch, wave number 1078.39cm-1 shows that the presence of alcohols functional group in medium sharp appearance with respective to C-O stretch, wave number 721.62cm-1 shows that the presence of alkanes functional group in weak sharp appearance with respective to -(CH2)n bend.

FTIR analysis of raw PP waste plastics, following types of functional groups are appeared such as wave number 3649.21cm-1 shows that the presence of alcohols functional group in medium sharp appearance with respective to O=H stretch, wave number 3438.08 cm-1 shows that the presence of alcohols functional group in medium sharp appearance with respective to O-H stretch, wave number 2991.98cm-1 shows that the presence of Alkanes functional group in strong appearance with respective to C-H stretch, wave number 2878.76cm-1shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 1752.76 cm-1 shows that the presence of ketones functional group in strong appearance with respective to C=O stretch, wave number 1679.22cm-1 shows that the presence of ketones functional group in strong appearance with respective to C=O stretch, wave number 1473.73cm-1 shows that the presence of aromatic compound functional group in medium sharp appearance with respective to ring=C stretch, wave number 1304.41cm-1shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F Stretch, wave number 1218.12cm-1shows that the presence of Alcohols functional group in medium sharp appearance with respective to C-O stretch, wave number 616.33cm-1shows that the presence of alkynes functional group in strong broad appearance with respective to ≡C-H bend and wave number 498.54cm-1shows that the presence of alkyl halides functional group in strong appearance with respective to C-I Stretch.

FTIR analysis of raw PS waste plastics, following types of functional groups, are appeared such as wavenumber 3645.41cm-1 shows that the presence of alcohols functional

group in medium sharp appearance with respective to O-H stretch, wave number 3489.81 cm-1 shows that the presence of alcohols functional group in strong broad appearance with respective to O-H stretch, wave number 3441.36cm-1 shows that the presence of alcohols functional group in strong broad appearance with respective to O-H stretch, wave number 2991.98cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2880.23cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 1755.73cm-1 shows that the presence of ketones functional group in strong appearance with respective to C=O stretch, wave number 1677.79cm-1 shows that the presence of ketones functional group in strong appearance with respective to C=O stretch, wave number 1598.62cm-1 shows that the presence of amides functional group in medium sharp appearance with respective to N-H bend, wave number 1305.35cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 1219.03cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 970.29cm-1 shows that the presence of alkenes functional group in strong appearance with respective to =C-H bend, wave number 614.63cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-Br stretch, wave number 495.24cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-I stretch.

Aromatic Liquid Hydrocarbon Fuel (ALHF) Analysis:

a) Effect of feedstock (plastic wastes) on ALHF yield:

The effect of different types of plastic feedstock (LDPE, HDPE, PP and PS) on pyrolysis product yields, especially on the liquid oils is shown in Fig (6). All types of plastic waste were degraded into liquid oil at the optimum pyrolysis temperature of 450ºC. PS plastic waste showed the maximum conversion of feedstock into liquid oil (81.6%) along with least gases (11.42%) and char (6.98%) in comparison to other plastic waste types such as LDPE, HDPE and PP. The results of the ALHF yield %, residue char % and pyro gas% formation are tabulated in Table - (7) and Fig.7.

The similar trend was reported such as that PS produced a maximum fraction of liquid oil in comparison to PE and PP plastic types(Ciliz et al., 2004). The maximum degradation of PS was occurred due to its simple structure in comparison to other plastic types(Siddiqui and Redhwi.,2009). Moreover, PS thermal degradation process includes mainly four steps that are initiation, transfer, decomposition and termination (Faravelli et al., 2001).

Figure (6) - showing the product of ALHF obtained from different waste plastics feedstock.

Table -7

Effect of different types of feedstock on ALHF yield at 450 ºC and 90 min.

Different Types of Feed Stock	Weight of Sample Taken (gm)	Pyrolytic Temperature maintained (ºC)	Pyrolytic Time required (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
LDPE	250	450	90	58.07	11.53	30.40
HDPE	250	450	90	66.04	14.55	19.41
PP	250	450	90	72.80	11.69	15.51
PS	250	450	90	81.60	6.98	11.42
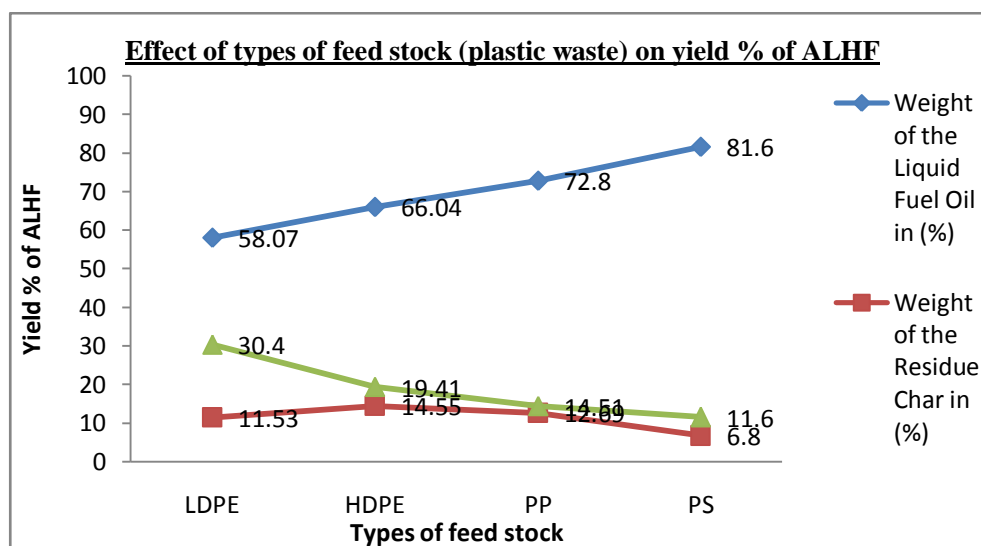
Fig. 7 shows the effect of types of feedstock (plastic wastes) on yield % of ALHF

b) Effect of pyrolytic temperature on ALHF yield:

Experiments were carried out at four different temperatures (350, 400, 450 and 500°C) to investigate the effect of temperature on the yield and quality of produced liquid oil. After the

determination of optimum temperature, experiments were carried out at four different reaction times (60, 75, 90 and 120 min) to investigate the effect on the feedstock decomposition and liquid oil. The data gathered during the experiments were tabulated in the Table: 8-11 and Fig 8a-8d.

The purpose of using different temperature and reaction time was to find the optimum temperature and reaction time for the pyrolysis of waste plastic feedstocks. From the experiments, it was observed that the lower reaction time to minimize the intensive energy demands of the process occurred at 90 minutes and achieved a higher percentage of decomposition rate at 450ºC. Whereas it was observed that the percentage yield of the liquid fuel oil was decreased at the maximum reaction time of 120 minutes, and hence it was ascertained that the rate of pyro gas formation was increased with increasing the rage of temperature [46].

According to the above, the maximum liquid fuel oil yield percentage was obtained from PS waste plastic of 81.06 % with char residue of 6.98 %, whereas the minimum liquid fuel oil yield percentage was obtained from LDPE waste plastic of 58.07 % with char residue of 11.53 %.

Table-8
Effect of Pyrolytic Temperature on yield % of ALHF obtained from LDPE at 90 minutes.

Pyrolytic Temperature in (ºC)	Weight of Sample Taken (gm)	Pyrolytic Time in (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
350	250	90	41.60	24.52	33.88
400	250	90	49.20	18.21	32.50
450	250	90	58.07	14.53	27.40
500	250	90	54.40	11.83	33.77

Table-9
Effect of Pyrolytic Temperature on yield % of ALHF obtained from HDPE at 90 minutes.

Pyrolytic Temperature in (ºC)	Weight of Sample Taken (gm)	Pyrolytic Time in (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
350	250	90	52.60	18.20	29.20
400	250	90	57.20	16.21	26.59
450	250	90	66.04	10.55	23.41
500	250	90	63.40	9.83	26.77

Table-10
Effect of Pyrolytic Temperature on yield % of ALHF obtained from PP at 90 minutes:

Pyrolytic Temperature in (ºC)	Weight of Sample Taken (gm)	Pyrolytic Time in (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
350	200	90	58.66	16.42	24.92
400	200	90	61.46	13.21	25.33
450	200	90	72.80	11.69	15.51
500	200	90	69.72	9.33	20.95

Table-11

Effect of Pyrolytic Temperature on yield % of ALHF obtained from PS at 90 minutes:

Pyrolytic Temperature in (ºC)	Weight of Sample Taken (gm)	Pyrolytic Time in (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
350	200	90	64.70	9.23	26.07
400	200	90	76.20	7.81	15.99
450	200	90	81.60	6.98	11.42
500	200	90	78.42	6.83	14.75
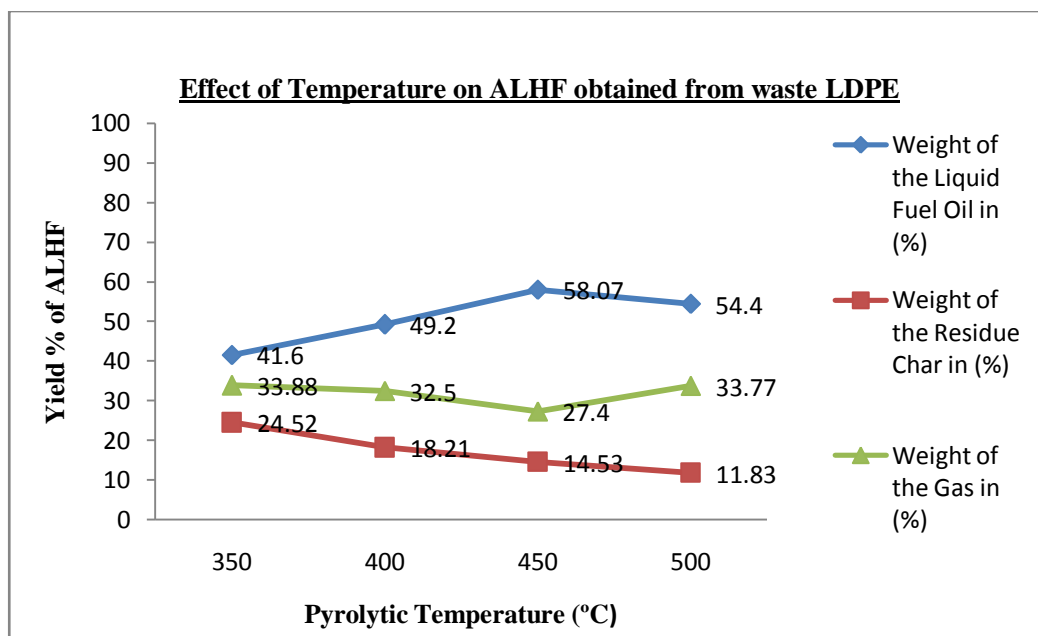
Fig.8(a): Effect of Pyrolytic Temperature on Yield percentage of ALHF obtained from LDPE plastic waste.
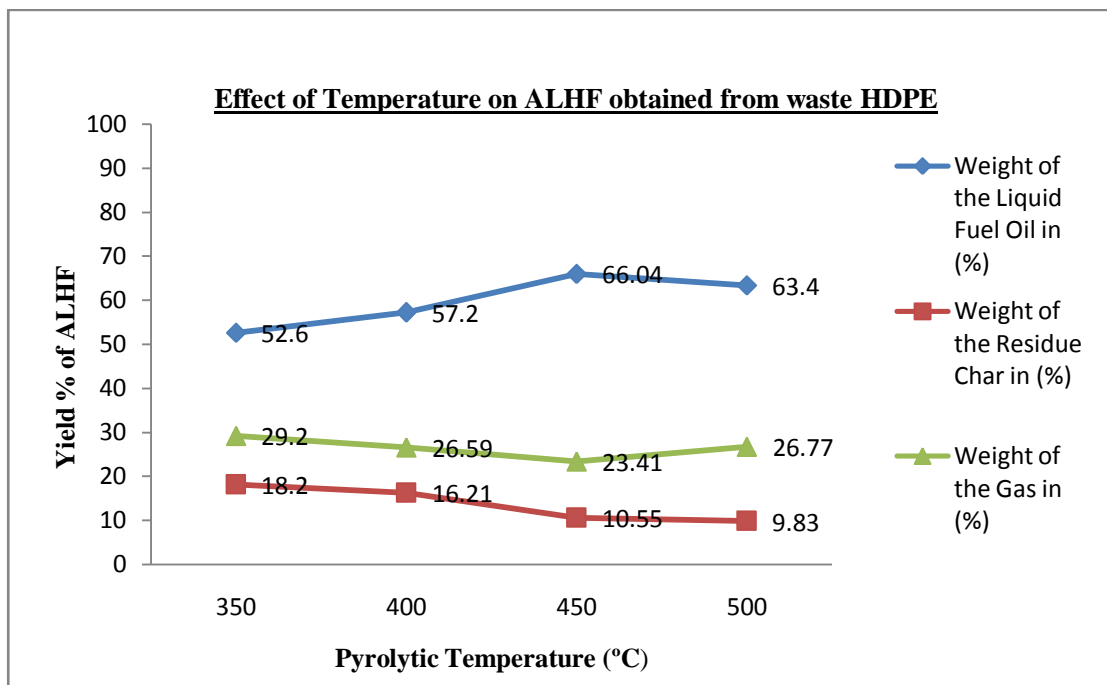
Fig.8 (b):   Effect of Pyrolytic Temperature on Yield percentage of ALHF obtained from HDPE plastic waste.
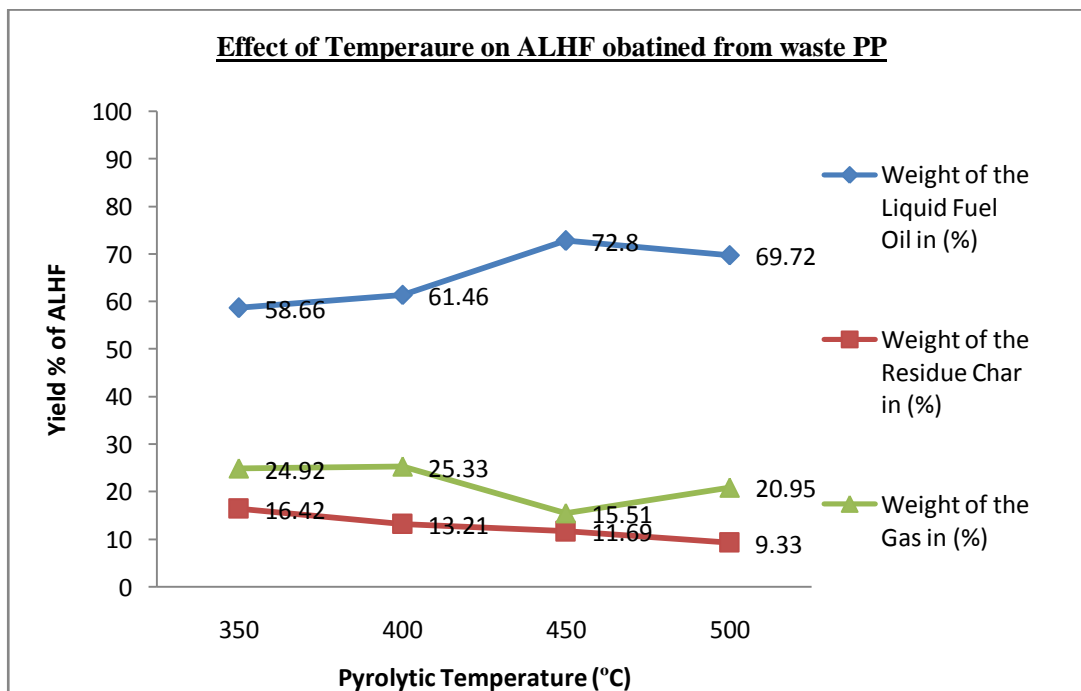
Fig.8(c): Effect of Pyrolytic Temperature on Yield percentage of ALHF obtained from PP plastic waste.
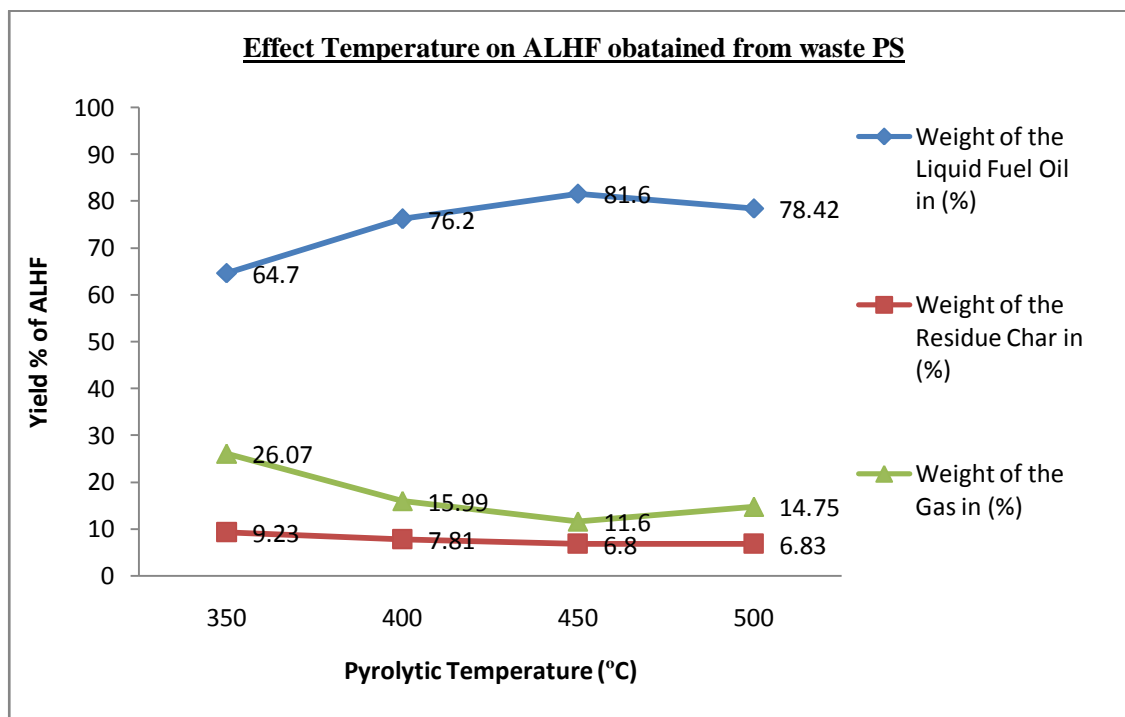
Fig.8 (d):   Effect of Pyrolytic Temperature on Yield percentage of ALHF obtained from PS plastic waste.

c)   Effect of Pyrolytic Time on ALHF yield:

The effect of reaction time on the liquid oil yield was studied against the optimum temperature of 450 °C at 60, 75, 90 and 120 min are tabulated in Table: 12-15 and Fig. 9 (a)-(d). The results showed insignificant difference in liquid oil production between the 90 and 120 min reaction times. The 90 min reaction time produced the maximum liquid oil yield of 81.6% as compared to 78.42% for a reaction time of 120 min. The char production was higher for a reaction time of 90 min as compared to 120 min (14.53 versus 6.83%).

Table-12
Effect of Pyrolytic Time on yield % of ALHF obtained from LDPE at 450 ºC with 250g feedstock.

Pyrolytic Time in (min)	Weight of Sample Taken (gm)	Pyrolytic Temperature in (ºC)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
60	250	450	32.50	29.80	37.70
75	250	450	36.48	26.60	36.92
90	250	450	58.07	14.53	27.40
120	250	450	56.40	10.80	32.80

Table-13

Effect of Pyrolytic Time on yield % of ALHF obtained from HDPE at 450 ºC with 250g feedstock.

Pyrolytic Time in (min)	Weight of Sample Taken (gm)	Pyrolytic Temperature in (ºC)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
60	250	450	38.60	18.20	56.80
75	250	450	49.10	15.42	35.48
90	250	450	66.04	10.55	23.41
120	250	450	64.12	9.78	26.10

Table-14

Effect of Pyrolytic Time on yield % of ALHF obtained from PP at 450 ºC with 250g feedstock.

Pyrolytic Temperature in (ºC)	Weight of Sample Taken (gm)	Pyrolytic Time in (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
60	250	450	42.14	15.86	42.00
75	250	450	59.44	13.76	26.80
90	250	450	72.80	11.69	15.51
120	250	450	70.14	10.06	19.80

Table-15
Effect of Pyrolytic Time on yield % of ALHF obtained from PS at 450 ºC with 250g feedstock.

Pyrolytic Temperature in (ºC)	Weight of Sample Taken (gm)	Pyrolytic Time in (min)	Weight of the Liquid Fuel Oil in (%)	Weight of the Residue Char in (%)	Weight of the Gas in (%)
60	250	450	52.20	9.23	38.57
75	250	450	71.56	7.81	20.63
90	250	450	81.60	6.98	11.42
120	250	450	79.50	6.83	13.67
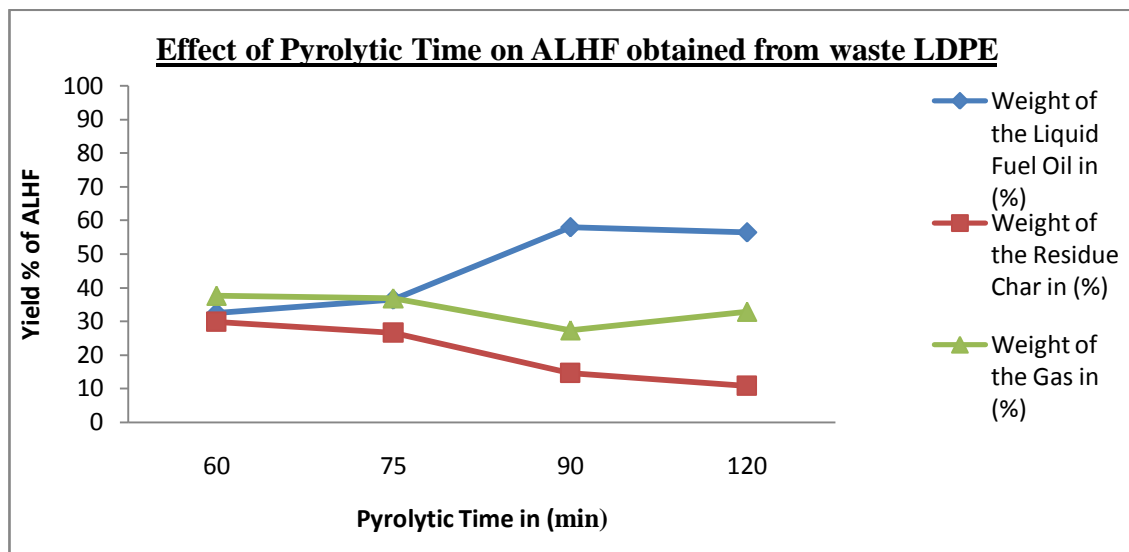
Fig.9 (a): Effect of Pyrolytic Time on yield percentage of ALHF obtained from LDPE plastic waste.
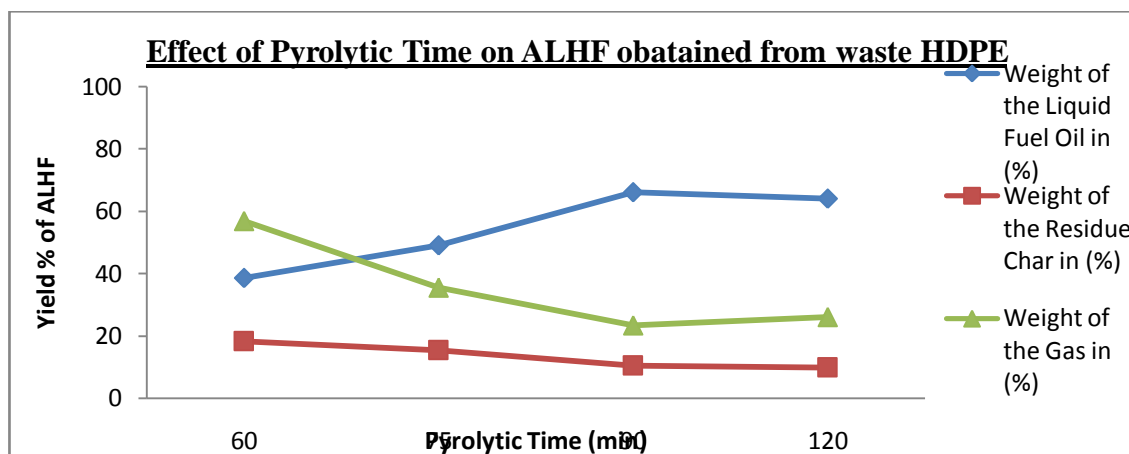
Fig.9 (b): Effect of Pyrolytic Time on yield percentage of ALHF obtained from HDPE plastic waste.
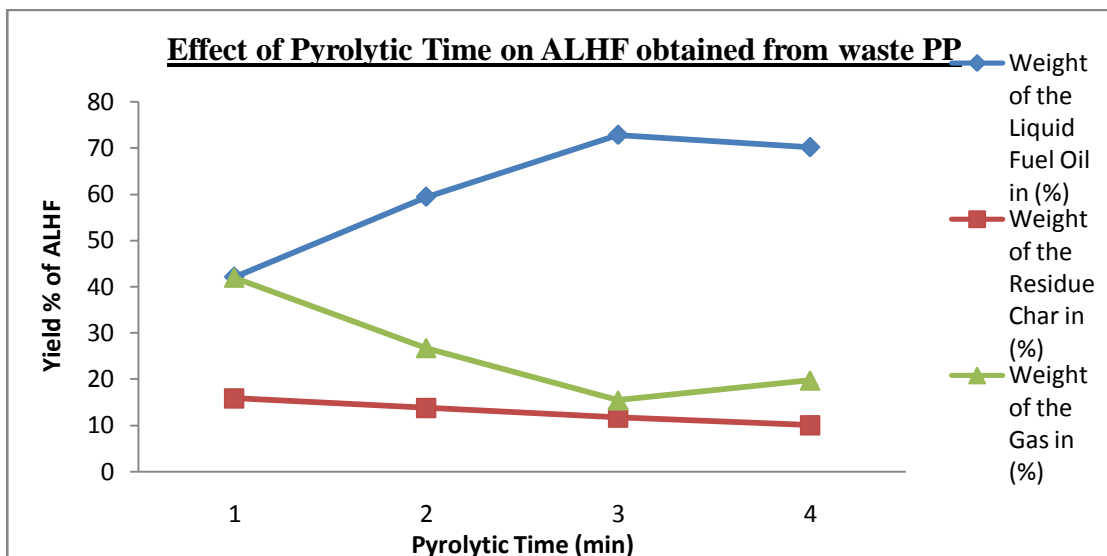
Fig.9 (c): Effect of Pyrolytic Time on yield percentage of ALHF obtained from PP plastic waste
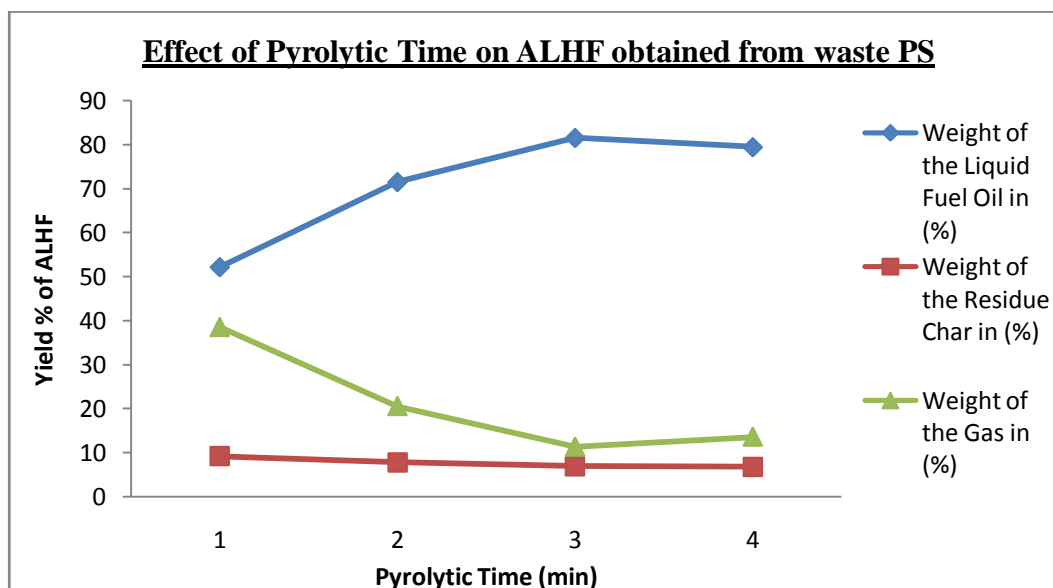
Fig.9 (d): Effect of Pyrolytic Time on yield percentage of ALHF obtained from PS plastic waste.

It can be stated that the extra reaction time shows similar yield for oil and char as 90 min reaction time [46]. Thus 90 min is suggested as the optimum reaction time. The lowest reaction time (60 min) produced more char and less liquid oil, suggesting that a 60 min reaction time is insufficient to convert the feedstock to liquid oil at maximum conversion efficiency.

Similar results were observed and reported on the yield of liquid oil with different reaction times(Lopez et al., 2011) and Lee (2007). However, the effect of reaction time on

pyrolysis is also one of the functions of the reactor dimensions and the heat transfer rate from the heating elements to the PS feedstock within the reactor (Jung et al., 2013) and (Ringer et al.,2006). Therefore, the reaction time may change with other reactor configurations, especially of a continuous flow reactor, which would be the type of reactor that is mostly used in the industrial application of the pyrolysis process (Chen et al.,2014) and (Miandad et al.,2016a,b).

d) Characteristics of ALHF by FT-IR:

FTIR analyses of ALHF obtained from the LDPE, HDPE, PP and PS waste plastics were performed and the functional groups appeared in the results are shown in Table: 16-19 and figures 10(a)-(d).

Table-16
FTIR analysis of ALHF obtained from LDPE plastic wastes.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3621.18	O-H stretch/ Medium sharp	Alcohol	1280.64	C-F Stretch/ very strong	Alkyl halides
2920.10	C-H stretch/ strong	Alkanes	1175.85	C-F Stretch/ very strong	Alkyl halides
2854.40	C-H stretch/ strong	Alkanes	1117.56	C-F Stretch/ very strong	Alkyl halides
2667.81	O-H stretch/ strong broad	Aldehyde	1024.04	C-F Stretch/ very strong	Alkyl halides
2543.12	S-H stretch/ weak	Thiol	799.18	=C-H bend/ strong	Alkenes
1696.02	C=O stretch/ strong	Conjugated aldehyde	710.61	C-H bend/ strong	Aromatic compound
1603.98	C=C stretch/ medium	Conjugated alkene	663.37	C-Br stretch/ strong	Alkyl halides
1454.55	C-H bend/ strong	Alkanes	544.38	C-Br stretch/ strong	Alkyl halides
1376.88	CH$_3$C-H Stretch/Medium	Alkanes			

Table-17
FTIR analysis of ALHF obtained from HDPE plastic wastes.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment / Appearance	Functional Group
3073.55	=C-H stretch/ weak, medium	Alkenes	1458.04	C-H bend/ strong	Alkanes
2924.25	C-H stretch/ strong	Alkanes	1373.47	CH$_3$C-H Stretch/ Medium	Alkanes
2857.06	C-H stretch/ strong	Alkanes	1281.30	C-F Stretch/ very strong	Alkyl halides
2672.62	O-H stretch/ strong, broad	Aldehyde	716.54	-(CH$_2$)$_n$ bend/ weak	Alkanes
1697.27	C=O stretch/ strong	Conjugated aldehyde	537.57	C-Br stretch/ strong	Alkyl halides
1642.68	C=C stretch/ very weak	Alkenes			

Table-18
FTIR analysis of ALHF obtained from PP plastic wastes.

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3648.79	O-H stretch/ Medium, sharp	Alcohol	1460.31	C-H bend/ strong	Alkanes
3311.88	≡C-H bend/ strong, sharp	Alkynes	1058.72	C-F Stretch/ very strong	Alkyl halides
2923.77	C-H stretch/ strong	Alkanes	980.32	C=C bend/ strong	Alkene
2855.88	C-H stretch/	Alkanes	719.35	C=C bend/	Alkene

	strong			strong	
1702.82	C-H bend/ weak	Aromatic compound	489.95	C-I stretch/ strong	Alkyl halides
1535.84	N-H bend/ Medium, sharp	Amides			

Table-19
FTIR analysis of ALHF obtained from PS plastic wastes

Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group	Wave Number (cm^{-1})	Assignment/ Appearance	Functional Group
3073.74	=C-H stretch/ weak, medium	Alkenes	1455.75	C-H bend/ strong	Alkanes
2919.22	C-H stretch/ strong	Alkanes	1375.70	CH$_3$C-H bend/ Medium	Alkanes
2854.01	C-H stretch/ strong	Alkanes	1283.52	C-F Stretch/ very strong	Alkyl halides/ Aromatic ester
2666.94	O-H stretch/ strong, broad	Aldehyde	1177.61	C-F Stretch/ very strong	Alkyl halides
2543.27	S-H stretch/ weak	Thiol	887.85	=C-H bend/ strong	Alkenes
1696.11	C=O stretch/ strong	Aldehydes	708.97	=C-H bend/ medium sharp	Alkenes
1598.30	ringC=C stretch/ Medium, sharp	Aromatic compound	540.11	C-Br stretch/ strong	Alkyl halides
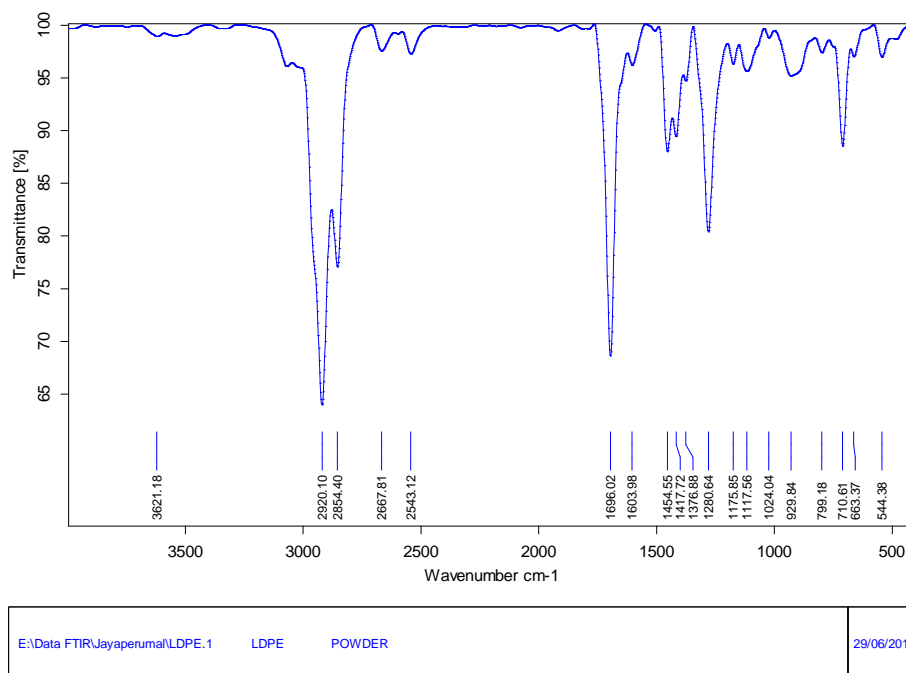
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Figures 10(a): Figure shows the FTIR analysis of ALHF obtained from LDPE waste plastics.
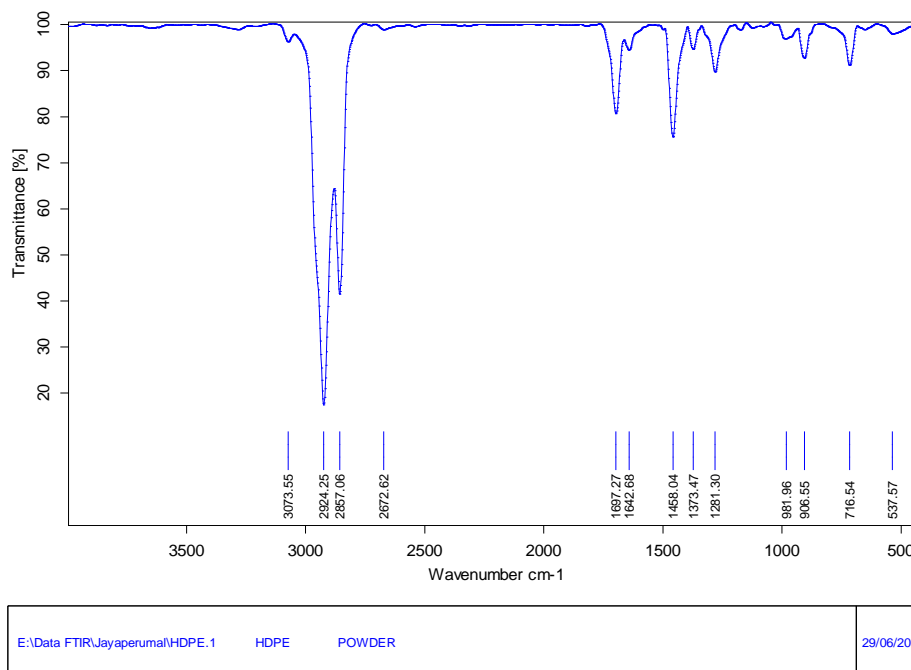
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Figures 10(b): Figure shows the FTIR analysis of ALHF obtained from HDPE waste plastics.
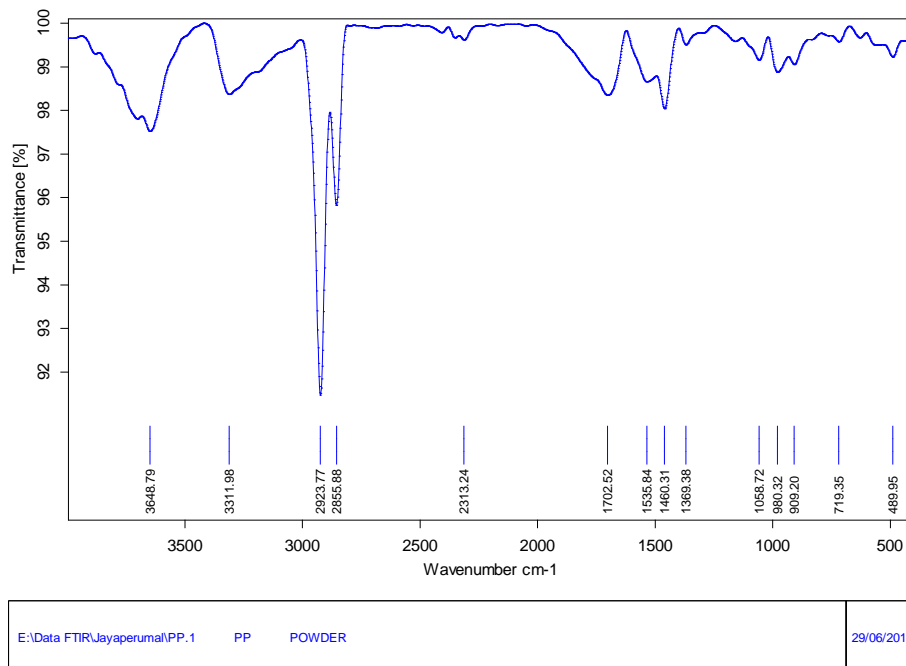
Figures 10(c): Figure shows the FTIR analysis of ALHF obtained from PP waste plastics.
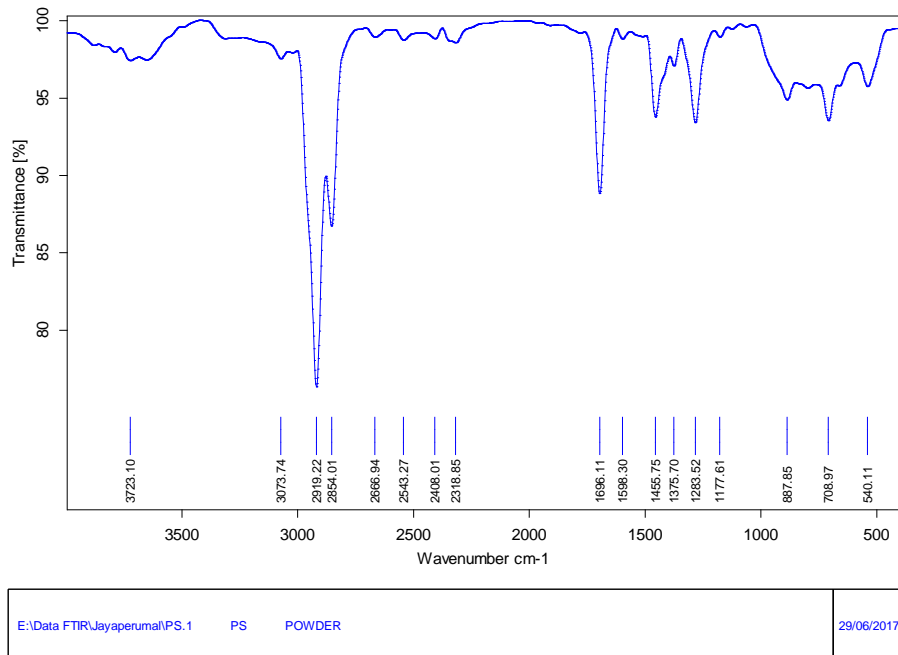
Figures 10(d): Figure shows the FTIR analysis of ALHF obtained from PP waste plastics.

From the FTIR results, the following functional types of groups appeared in the ALHF obtained from the LDPE waste plastics such as wave number 3621.18cm-1 shows that the presence of alcohols functional group in medium sharp appearance with respective to O-H

stretch, wave number 2920.10cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2854.40cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2667.81cm-1 shows that the presence of aldehyde functional group in strong broad appearance with respective to O-H stretch, wave number 2543.12cm-1 shows that the presence of thiol functional group in weak appearance with respective to S-H stretch, wave number 1696.02cm-1 shows that the presence of conjugated aldehyde functional group in strong appearance with respective to C=O stretch, wave number 1603.98cm-1 shows that the presence of conjugated alkene functional group in medium appearance with respective to C=C stretch, wave number 1280.64cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F bend, wave number 1175.85cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F Stretch, wave number 1117.56cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 799.18cm-1 shows that the presence of alkenes functional group in strong appearance with respective to =C-H bend, wave number 710.61cm-1 shows that the presence of aromatic compound functional group in strong appearance with respective to C-H bend, wave number 663.37cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-Br stretch and wave number 544.38cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-Br stretch.

FTIR analysis of ALHF obtained from the HDPE waste plastics, following types of functional groups are appeared such as wave number 3073.55cm-1 shows that the presence of alkenes functional group in weak medium sharp appearance with respective to =C-H stretch, wave number 2924.25cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2857.06cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2672.62cm-1 shows that the presence of aldehyde functional group in strong broad appearance with respective to O-H stretch, wave number 2543.12cm-1 shows that the presence of thiol functional group in weak appearance with respective to S-H stretch, wave number 1697.27cm-1 shows that the presence of conjugated aldehyde functional group in strong appearance with respective to C=O stretch, wave number 1642.68cm-1 shows that the presence of alkene functional group in very weak appearance with respective to C=C stretch, wave number 1458.04cm-1 shows that the presence of Alkanes functional group in very strong appearance with respective to C-H bend, wave number 1373.47cm-1 shows that the presence of Alkanes functional group in medium appearance with respective to CH3C-H Stretch, wave number 1281.30cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 716.54cm-1 shows that the presence of alkanes functional group in weak appearance with respective to -(CH2)n bend and wave number 537.57cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-Br stretch.

FTIR analysis of ALHF obtained from the PP waste plastics, following types of functional groups are appeared such as wave number 3648.79cm-1 shows that the presence of alcohols functional group in medium sharp appearance with respective to O-H stretch, wave number 3311.88cm-1 shows that the presence of alkynes functional group in strong sharp appearance with respective to ≡C-H bend, wave number 2923.77cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2855.88cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 1702.82cm-1 shows that the presence of aromatic compound functional group in weak appearance with respective to C-H bend, wave number 1535.84cm-1 shows that the presence of amides functional group in medium sharp appearance with respective to N-H bend, wave number 1460.31cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H bend, wave number 1058.72cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 980.32cm-1 shows that the presence of alkenes functional group in strong appearance with respective to C=C bend, wave number 719.35cm-1 shows that the presence of alkene functional group in strong appearance with respective to C=C bend and wave number 489.95cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-I stretch.

FTIR analysis of ALHF obtained from the PS waste plastics, following types of functional groups are appeared such as wave number 3073.74cm-1 shows that the presence of alkenes functional group in weak medium sharp appearance with respective to =C-H stretch, wave number 2919.22cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2854.01cm-1 shows that the presence of alkanes functional group in strong appearance with respective to C-H stretch, wave number 2666.94cm-1 shows that the presence of aldehyde functional group in strong broad appearance with respective to O-H stretch, wave number 2543.27cm-1 shows that the presence of thiol functional group in weak appearance with respective to S-H stretch, wave number 1696.11cm-1 shows that the presence of aldehyde functional group in strong appearance with respective to C=O stretch, wave number 1598.30cm-1 shows that the presence of aromatic compound functional group in medium sharp appearance with respective to ringC=C stretch, wave number 1455.75cm-1 shows that the presence of Alkanes functional group in strong appearance with respective to C-H bend, wave number 1375.70cm-1 shows that the presence of Alkanes functional group in medium appearance with respective to CH3C-H bend, wave number 1283.52cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 1177.61cm-1 shows that the presence of alkyl halides functional group in very strong appearance with respective to C-F stretch, wave number 887.85cm-1 shows that the presence of alkenes functional group in strong appearance with respective to =C-H bend, wave number 708.97cm-1 shows that the presence of alkenes functional group in medium sharp appearance with respective to =C-H bend and wave number 540.11cm-1 shows that the presence of alkyl halides functional group in strong appearance with respective to C-Br stretch.

e) Characteristics of ALHF by GC-MS Analysis:

GC-Ms analyses of ALHF obtained from the LDPE, HDPE, PP and PS waste plastics were performed and the functional groups appeared in the results are shown in Table: 20-23 and Fig. 11a-11d.

From the GC-Ms analysis, the following hydrocarbon chain compounds are appeared in the ALHF obtained from the LDPE waste plastics such as according to the retention time 6.110 compound is Cyclopentane, 1,2,3-trimethyl-,.alpha.,2.alpha.,3.alpha.)- (C4H10), retention time 6.219 compound is 1-Decene (C5H10), retention time 6.357 compound is Undecane (C6H12), retention time 6.452 compound is 3-Acetyl-2-octanone (C7H14), retention time 6.524 compound is Dimethylmalonic acid, 4-chlorophenyl hexadecyl ester (C7H16), retention time 6.795 compound is Hydrazine, 1,1-diethyl-2-pentyl-(), retention time 7.556 compound is 4-Methyl-2-heptene (C8H18), retention time 7.627 compound is 4,4-Difluororetinol (all-trans) (C9H18), retention time 7.817 compound is Cyclopropane, 1-heptyl-2-methyl- (C9H20), retention time 7.950 compound is Undecane (C10H20), retention time 9.344 compound is compound is 1-Trideceneacid (C10H22), retention time 9.467 compound is Dodecane (C11H22), retention time 10.204 compound is 1-Butoxy-1-isobutoxy-butane (C11H24) ,retention time 10.789 compound is 1-Tridecene (C10H24), retention time 10.899 compound is Tridecane (C12H26), retention time 11.127 compound is 2-Methyl-2-docosene (C13H28), retention time 12.154 compound is 1-Tetradecene (C13H28), retention time 12.259 compound is Tetradecane (C14H28) , retention time 13.443 compound is 1-Pentadecene (C14H30), retention time 13.538 compound is Pentadecane (C15H30), retention time 14.660 compound is Cetene (C15H32), retention time 14.746 compound is Nonadecane (C16H32), retention time 15.821 compound is 1-Heptadecene (C16H34), retention time 15.897 compound is Heptadecane (C16H30O), retention time 16.919 compound is 1-Octadecene (C19H40), retention time 16.991 compound is Octacosane (C20H42), retention time 17.966 compound is E-15-Heptadecenal (C21H44), retention time 18.032 compound is Octacosane (C21H44) as well, retention time 18.969 compound is 1-Nonadecene (C24H50), retention time 19.026 compound is Heneicosane (C21H44), retention time 19.925 compound is Cyclotetracosane (C28H58), retention time 19.977 compound is Octacosane (C28H58), retention time 20.838 compound is 9-Hexacosene (C28H58), retention time 20.890 compound is Tetracosane (C28H58), retention time 21.761 compound is Octacosane (C7H16), retention time 22.602 compound is Tetracosane () respectively.

From the GC-Ms analysis, the following hydrocarbon chain compounds are appeared in the ALHF obtained from the HDPE waste plastics such as according to the retention time 5.254 compound is Cyclohexane, 1,1'-(2-ethyl-1,3-propanediyl)bis- (C4H10), retention time 5.492 compound is 4-Nonyne (C5H10), retention time 5.882 compound is Ethane, isocyanato-(C6H12), retention time 6.110 compound is Cyclopentane, 1,1,3,3-tetramethyl- (C7H14), retention time 6.224 compound is 1-Decene (C7H16), retention time 6.305 compound is 2,6,10-Dodecatrienal, 3,7,11-trimethyl-, (E,E)-, retention time 6.362 compound is Decane (C8H18), retention time 6.457 compound is Dimethylmalonic acid, 4-acetylphenyl undecyl ester (C9H18), retention time 6.528 compound is Octadecane, 2,6-dimethyl- (C9H20), retention time 6.823

compound is 1-Hexanol, 2-ethyl- (C10H20), retention time 7.299 compound is compound is (2-Methyl-[1,3]dioxolan-2-yl)-acetic   acid   [1-(4-methoxy-3-nitro-phenyl)-ethylidene]-hydrazide (C10H22), retention time 7.560 compound is 1-Hexadecanol, 2-methyl- (C11H22), retention time 7.627 compound is 1-Bromo-11-iodoundecane (C11H24) ,retention time 7.713 compound is 3-Undecene, 9-methyl-, (Z)- (C10H24), retention time 7.822 compound is 3-Tetradecene, (Z)-(C12H26), retention time 7.955 compound is Undecane (C13H28), retention time 8.031 compound is Octanoic acid, 8,8'-diselenodi- (C13H28), retention time 9.234 compound is 5-Undecene, 3-methyl-, (E)- (C14H28) , retention time 9.348 compound is 1-Dodecene (C14H30), retention time 9.472 compound is Dodecane (C15H30), retention time 9.543 compound is Molybdenum, tetrakis[.mu.-(acetato-O:O')]di-, (Mo-Mo) (C15H32), retention time 10.685 compound is Oxane-2,4-dione, 6-(4-bromophenyl)-5-ethyl-3,3-diimethyl-, trans- (C16H32), retention time 10.794 compound is 1-Tridecene (C16H34), retention time 10.908 compound is Tridecane (C16H30O), retention time 11.013 compound is Pyridine-3-carboxamide, oxime, N-2-trifluoromethylphenyl)- (C19H40), retention time 11.127 compound is Bacchotricuneatin c (C20H42), retention time 12.059 compound is Pregn-5-en-18-ol, 20-amino-3-(methylamino)-, (3.beta.,20S)- (C21H44), retention time 12.159 compound is 2-Tetradecene, (E)- (C21H44) as well, retention time 12.264 compound is Tetradecane (C24H50), retention time 13.448 compound is 1-Pentadecene (C21H44), retention time 13.543 compound is Pentadecane (C28H58), retention time 14.580 compound is Benzenemethanamine, 2-amino-3,5-dibromo-N-cyclohexyl-N-methyl- (C28H58), retention time 14.665 compound is Cetene (C28H58), retention time 14.751 compound is Heptadecane (C28H58), retention time 15.826 compound is E-14-Hexadecenal (C7H16), retention time 15.902 compound is Nonadecane, retention time 16.924 compound is 1-Octadecene (C8H18), retention time 16.995 compound is Octadecane (C9H18), retention time 17.970 compound is E-15-Heptadecenal (C9H20), retention time 18.037 compound is Octacosane (C10H20), retention time 18.969 compound is 1-Nonadecene (C10H22), retention time 19.031 compound is Hexacosane (C11H22), retention time 19.925 compound is 9-Tricosene, (Z)- (C11H24) , retention time 19.982 compound is Tetracosane (C10H24), retention time 20.890 compound is Octacosane (C12H26), retention time 21.765 compound is Octacosane (C13H28), retention time 22.602 compound is Tetracosane (C13H28) respectively.

From the GC-Ms analysis, the following hydrocarbon chain compounds are appeared in the ALHF obtained from the PP waste plastics such as in detail analysis according to the retention time 5.121 compound is Cyclohexene, 4-methyl (C4H10), retention time 5.168 compound is Benzene, (1-methylethyl) (C5H10), retention time 5.335 compound is 1-Pentanol, 2-methyl-, acetate (C6H12), retention time 5.373 compound is 2-Heptanone, 4-methyl- (C7H14), retention time 5.482 compound is Cyclohexane (C7H16), retention time 5.639 compound is trans-3-Decene, retention time 5.891 compound is Benzene, 1,2,3-trimethyl (C8H18), retention time 5.958 compound is Spiro[4.5]decane (C9H18), retention time 6.110 compound is alpha-Methylstyrene (C9H20), retention time 6.181 compound is 2,6-Octadiene, 2,6-dimethyl (C10H20), retention time 6.238 compound is compound is Heptane, 2-methyl-3-methylene (C10H22), retention time 6.267 compound is 2-Decene, 4-methyl-, (Z) (C11H22), retention time 6.319 compound is Cyclopropane, (1,2-dimethylpropyl) (C11H24) ,retention time 6.357

compound is Succinic acid, di(cis-hex-3-enyl) ester (C10H24), retention time 6.524 compound is Undecane, 4,6-dimethyl- (C12H26), retention time 6.609 compound is Heptane, 3,3,5-trimethyl- (C13H28), retention time 7.256 compound is 2-Decene, 2,4-dimethyl- (C13H28), retention time 7.327 compound is 2-Decene, 2,4-dimethyl- (C14H28) , retention time 7.665 compound is Cyclohexane, 1,1,3,5-tetramethyl-, trans- (C14H30), retention time 7.741 compound is 2-Undecene, 7-methyl- (C15H30), retention time 7.936 compound is Cyclohexane, 2,4-diethyl-1-methyl- (C15H32), retention time 8.217 compound is Cyclohexanecarboxylic acid, 4-propyl-, 4-cyanophenyl ester, trans- (C16H32), retention time 8.316 compound is 2,3-Dimethyl-3-heptene, (Z)- (C16H34), retention time 8.416 compound is 2,3-Dimethyl-3-heptene (C16H30O), retention compound is 1,3-Diisopropyl cyclohexane (C17H32O), retention time 8.716 compound is 1,4-Diisopropyl cyclohexane (C19H40), retention time 8.911 compound is Zinc, bis[2-(1,1-dimethylethyl)-3, 3-dimethylcyclopropyl]-, [1.alpha.(1R*,2R*),2.beta.]- (C20H42), retention time 9.134 compound is Cyclohexane, 2,4-diethyl-1-methyl- (C21H44), retention time 9.539 compound is Cyclohexane, 2,4-diethyl-1-methyl- (C21H44) as well, retention time 9.924 compound is Dodecane, 4,6-dimethyl- (C24H50), retention time 10.052 compound is Dodecane, 4,6-dimethyl- (C21H44), retention time 10.147 compound is Dodecane, 2,6,10-trimethyl- (C28H58), retention time 10.461 compound is Oxalic acid, cyclohexyldodecylester (C28H58), retention time 10.808 compound is Oxalic acid, cyclohexyltetradecylester (C28H58), retention time 10.956 compound is 2,3-Dimethyl-3-heptene, (Z)- (C28H58), retention time 11.079 compound is Cyclohexane, 1,1-dimethyl-2-propyl (C7H16), retention time 11.203 compound is Cyclopentane, 1,2-dipropyl-, retention time 11.507 compound is Pyridine-3-carboxamide, oxime, N-(2-trifluoromethylphenyl)-, 1,2,3-trimethyl (C8H18), retention time 11.859 compound is 1,4-Hexadiene, 3,3,5-trimethyl- (C9H18), retention time 12.963 compound is Dodecane, 4,6-dimethyl- (C9H20), retention time 13.196 compound is Tridecane, 4-methyl- (C10H20), retention time 13.728 compound is Nonadecylpentafluoropropionate (C10H22), retention time 13.847 compound is Cyclohexane, 1,2,4-trimethyl- (C11H22), retention time 13.938 compound is Cyclohexane, 1,2,4-trimethyl- (1,2-dimethylpropyl) (C11H24) , retention time 14.066 compound is Cyclohexane, 1,2,4-trimethyl- (C10H24), retention time 14.180 compound is Cyclohexane, 1,2,4-trimethyl- (C12H26), retention time 15.455 compound is Benzene, 1,1'-(1,3-propanediyl)bis (C13H28), retention time 16.196 compound is Nonadecylpentafluoropropionate (C13H28), retention time 16.520 compound is Nonadecylpentafluoropropionate (C14H28) , retention time 16.857 compound is 2-Methyl-2-docosene (C14H30) respectively.

From the GC-Ms analysis, the following hydrocarbon chain compounds are appeared in the ALHF obtained from the PS waste plastics such as in detail analysis according to the retention time 5.159 compound is Benzene, (1-methyl ethyl) (C9H12), retention time 6.129 compound is alpha-Methylstyrene (C9H10), retention time 15.474 compound is Benzene, 1,1'-(1,3-propanediol)bis (C15H16), retention time 15.759 compound is Benzene, 1,1'-(1-methyl-1,3-propanediyl)bis (C16H18), retention time 16.220 compound is 3-(Benzylthio)acrylic acid, methylester (C11H12O2S), retention time 16.396 compound is 1,2-Diphenylcyclopropane (C15H14), retention time 23.002 compound is Ethisterone (C21H28O2) respectively.

Table-20

CG-MS analyses of ALHF obtained from LDPE plastic wastes.

Number of Peak	Retention Time (min)	Compound Name	CAS Number
1	6.110	Cyclopentane, 1,2,3-trimethyl-, (1.alpha.,2.alpha.,3.alpha.)-	002613-69-6
2	6.219	1-Decene	000872-05-9
3	6.357	Undecane	001120-21-4
4	6.452	3-Acetyl-2-octanone	027970-50-9
5	6.524	Heptadecane, 7-methyl-	1000361-98-4
6	6.795	Hydrazine, 1,1-diethyl-2-pentyl-	067398-41-8
7	7.556	4-Methyl-2-heptene	003404-56-6
8	7.627	4,4-Difluororetinol (all-trans)	090660-21-2
9	7.817	Cyclopropane, 1-heptyl-2-methyl-	074663-91-5
10	7.950	Undecane	001120-21-4
11	9.344	1-Tridecene	002437-56-1
12	9.467	Dodecane	000112-40-3
13	10.204	1-Butoxy-1-isobutoxy-butane	020266-12-0
14	10.789	1-Tridecene	002437-56-1
15	10.899	Tridecane	000629-50-5
16	11.127	-Methyl-2-docosene	1000131-16-9
17	12.154	1-Tetradecene	001120-36-1
18	12.259	Tetradecane	000629-59-4
19	13.443	1-Pentadecene	013360-61-7
20	13.538	Pentadecane	000629-62-9
21	14.660	Cetene	000629-73-2
22	14.746	Nonadecane	000629-92-5
23	15.821	1-Heptadecene	006765-39-5
24	15.897	Heptadecane	000629-78-7
25	16.919	1-Octadecene	000112-88-9
26	16.991	Octacosane	000630-02-4
27	17.966	E-15-Heptadecenal	1000130-97-9
28	18.032	Octacosane	000630-02-4
29	18.969	1-Nonadecene	018435-45-5
30	19.026	Heneicosane	000629-94-7
31	19.925	Cyclotetracosane	000297-03-0
32	19.977	Octacosane	000630-02-4
33	20.838	9-Hexacosene	071502-22-2
34	20.890	Tetracosane	000646-31-1
35	21.761	Octacosane	000646-31-1

| 36 | 22.602 | Tetracosane | 002613-69-6 |

Table-21
CG-MS analyses of ALHF obtained from HDPE plastic wastes.

Number of Peak	Retention Time (min)	Compound Name	CAS Number
1	5.254	Cyclohexane, 1,1'-(2-ethyl-1,3-pro	054833-34-0
2	5.492	4-Nonyne	020184-91-2
3	5.882	Ethane, isocyanato-	000109-90-0
4	6.110	Cyclopentane, 1,1,3,3-tetramethyl-	050876-33-0
5	6.224	1-Decene	000872-05-9
6	6.305	2,6,10-Dodecatrienal, 3,7,11-trimethyl-, (E,E)-	000502-67-0
7	6.362	Decane	000124-18-5
8	6.457	Dimethylmalonic acid, 4-acetylphenyl undecyl ester	1000363-70-5
9	6.528	Octadecane, 2,6-dimethyl-	075163-97-2
10	6.823	1-Hexanol, 2-ethyl-	000104-76-7
11	7.299	(2-Methyl-[1,3]dioxolan-2-yl)-acetic acid [1-(4-methoxy-3-nitro-phenyl)-ethylidene]-hydrazide	339337-14-3
12	7.560	1-Hexadecanol, 2-methyl-	002490-48-4
13	7.627	1-Bromo-11-iodoundecane	139123-69-6
14	7.713	3-Undecene, 9-methyl-, (Z)-	074630-50-5
15	7.822	3-Tetradecene, (Z)-	041446-67-7
16	7.955	Undecane	001120-21-4
17	8.031	Octanoic acid, 8,8'-diselenodi-	022686-32-4
18	9.234	5-Undecene, 3-methyl-, (E)-	074630-67-4
19	9.348	1-Dodecene	000112-41-4

20	9.472	Dodecane	000112-40-3
21	9.543	Cycloartanol	014221-06-8
22	10.685	Oxane-2,4-dione, 6-(4-bromophenyl)	293751-51-6
23	10.794	1-Tridecene	002437-56-1
24	10.908	Tridecane	000629-50-5
25	11.013	Pyridine-3-carboxamide, oxime, N-	288246-53-7
26	11.127	Bacchotricuneatin c	053366-38-4
27	12.059	5-Undecene, 3-methyl-, (E)-	066563-30-2
28	12.159	2-Tetradecene, (E)-	027741-48-6
29	12.264	Tetradecane	035953-54-9
30	13.448	1-Pentadecene	000629-59-4
31	13.543	Pentadecane	013360-61-7
32	14.580	Benzenemethanamine, 2-amino-3,5-dibromo-N-cyclohexyl-N-methyl-	000629-62-9
33	14.665	Cetene	003572-43-8
34	14.751	Heptadecane	000629-73-2
35	15.826	E-14-Hexadecenal	000629-78-7
36	15.902	Nonadecane	330207-53-9
37	16.924	1-Octadecene	000629-92-5
38	16.995	Octadecane	000112-88-9
39	17.970	E-15-Heptadecenal	000593-45-3
40	18.037	Octacosane	000630-02-4
41	18.969	1-Nonadecene	018435-45-5
42	19.031	Hexacosane	000630-01-3
43	19.925	9-Tricosene, (Z)-	027519-02-4
44	19.982	Tetracosane	000646-31-1
45	20.890	Octacosane	000630-02-4
46	21.765	Octacosane	000630-02-4
47	22.602	Tetracosane	000646-31-1

Table-22

CG-MS analyses of ALHF obtained from PP plastic wastes.

Number of Peak	Retention Time (min)	Compound Name	CAS Number
1	5.121	Cyclohexene,4-methyl	591-47-9
2	5.168	Benzene,(1-methylethyl	98-82-8
3	5.335	1-Pentanol, 2-methyl-, acetate	7789-99-3
4	5.373	2-Heptanone, 4-methyl	6137-06-0
5	5.482	Cyclohexane	110-82-7
6	5.639	trans-3-Decene	019150-21-1
7	5.891	Benzene, 1,2,3-trimethyl	526-73-8
8	5.958	Spiro[4.5]decane	176-63-6

9	6.110	.alpha.-Methylstyrene	98-83-9
10	6.181	2,6-Octadiene, 2,6-dimethyl	2792-39-4
11	6.238	Heptane, 2-methyl-3-methylene	062187-11-5
12	6.267	2-Decene, 4-methyl-, (Z)	074630-30-1
13	6.319	Cyclopropane, (1,2-dimethylpropyl)	6976-27-8
14	6.357	Succinic acid, di(cis-hex-3-enyl)ester	353-42-2
15	6.524	Undecane, 4,6-dimethyl	017312-82-2
16	6.609	Heptane, 3,3,5-trimethyl	7154-80-5
17	7.256	2-Decene, 2,4-dimethyl	074421-03-7
18	7.327	2-Decene, 2,4-dimethyl	74421-03-7
19	7.665	Cyclohexane, 1,1,3,5-tetramethyl-, trans	50876-31-8
20	7.741	2-Undecene, 7-methyl	61-83-0
21	7.936	Cyclohexane, 2,4-diethyl-1-methyl	061142-70-9
22	8.217	Cyclohexanecarboxylic acid, 4-propyl-, 4-cyanophenyl ester, trans	62439-33-2
23	8.316	2,3-Dimethyl-3-heptene, (Z)	59643-73-1
24	8.416	2,3-Dimethyl-3-heptene	1000113-49-3
25	8.611	3-Undecene, 8-methyl	1000061-84-4
26	8.678	1,3-Diisopropyl cyclohexane	7045-70-7
27	8.716	1,4-Diisopropyl cyclohexane	022907-72-8
28	8.911	Zinc, bis[2-(1,1-dimethylethyl)-3, 3-dimethylcyclopropyl]-, [1.alpha.(1R*,2R*),2.beta.]-	074793-36-5
29	9.134	Cyclohexane, 2,4-diethyl-1-methyl	061142-70-9
30	9.539	Cyclohexane, 2,4-diethyl-1-methyl	061142-70-9
31	9.924	Dodecane, 4,6-dimethyl	061141-72-8
32	10.052	Dodecane, 4,6-dimethyl	061141-72-8
33	10.147	Dodecane, 2,6,10-trimethyl	3891-98-3
34	10.461	Oxalic acid, cyclohexyl dodecyl ester	1000309-31-4
35	10.808	Oxalic acid, cyclohexyltetradecylester	1000309-31-5
36	10.956	2,3-Dimethyl-3-heptene, (Z)	059643-73-1
37	11.079	Cyclohexane, 1,1-dimethyl-2-propyl	081983-71-3
38	11.203	Cyclopentane, 1,2-dipropyl	091242-57-8
39	11.507	Pyridine-3-carboxamide, oxime, N-2-trifluoromethylphenyl)	288246-53-7
40	11.859	1,4-Hexadiene, 3,3,5-trimethyl	074753-00-7
41	12.963	Dodecane, 4,6-dimethyl	061141-72-8
42	13.196	Tridecane, 4-methyl	026730-12-1
43	13.728	Nonadecylpentafluoropropionate	1000351-88-8
44	13.847	Cyclohexane, 1,2,4-trimethyl	2234-75-5
45	13.938	Cyclohexane, 1,2,4-trimethyl	2234-75-5

46	14.066	Cyclohexane, 1,2,4-trimethyl	2234-75-5
47	14.180	Cyclohexane, 1,2,4-trimethyl	2234-75-5
48	15.455	Benzene, 1,1'-(1,3-propanediyl)bis	1081-75-0
49	16.196	Nonadecylpentafluoropropionate	1000351-88-8
50	16.520	Nonadecylpentafluoropropionate	1000351-88-8
51	16.857	2-Methyl-2-docosene	1000131-16-9

Table-23

CG-MS analyses of ALHF obtained from PS plastic wastes.

Number of Peak	Retention Time (min)	Compound Name	CAS Number
1	5.159	Benzene, (1-methylethyl)-	000098-82-8
2	6.129	.alpha.-Methylstyrene	000098-83-9
3	15.474	Benzene, 1,1'-(1,3-propanediyl)bis	001081-75-0
4	15.759	Benzene, 1,1'-(1-methyl-1,3-propanediyl)bis-	001520-44-1
5	16.220	3-(Benzylthio)acrylic acid, methylester	000192-96-8
6	16.396	1,2-Diphenylcyclopropane	029881-14-9
7	23.002	Ethisterone	000434-03-7
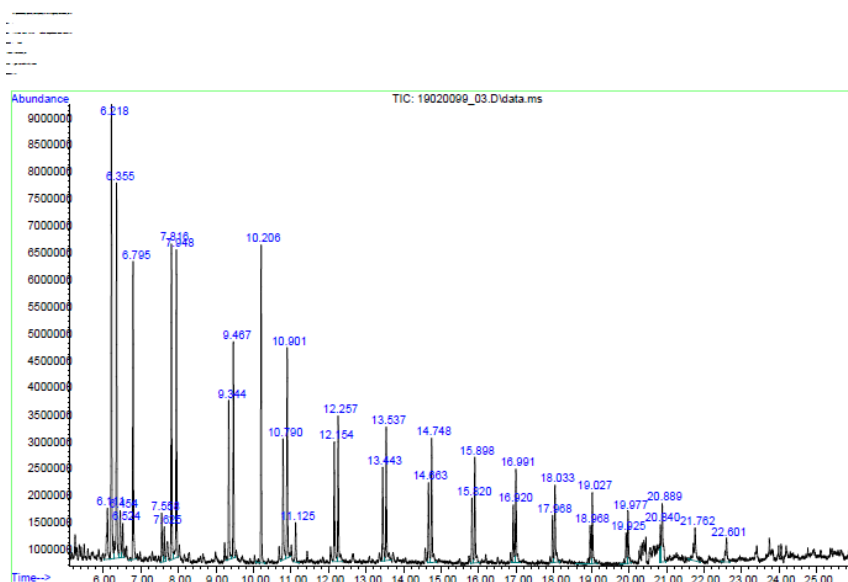
Figures 11(a): Figure shows the GC-Ms analysis of ALHF obtained from LDPE waste
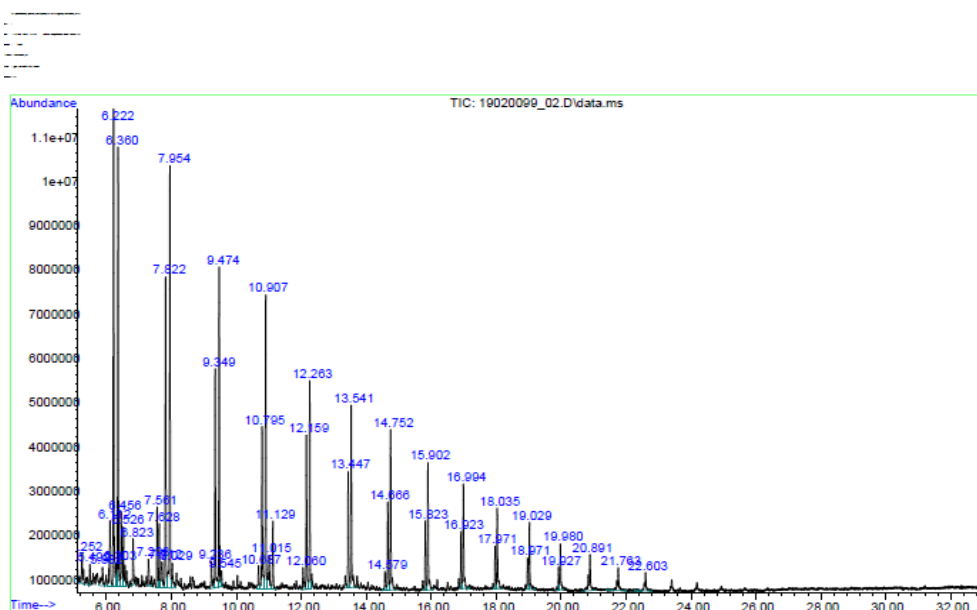
plastics.

Figures 11(b): Figure shows the GC-Ms analysis of ALHF obtained from HDPE waste plastics.
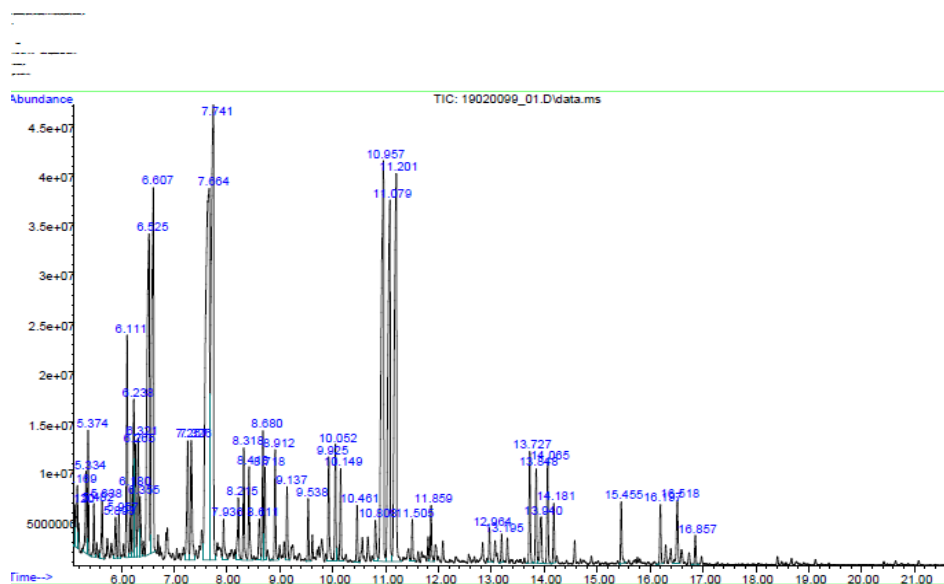
Figures 11(c): Figure shows the GC-Ms analysis of ALHF obtained from PPwaste plastics.
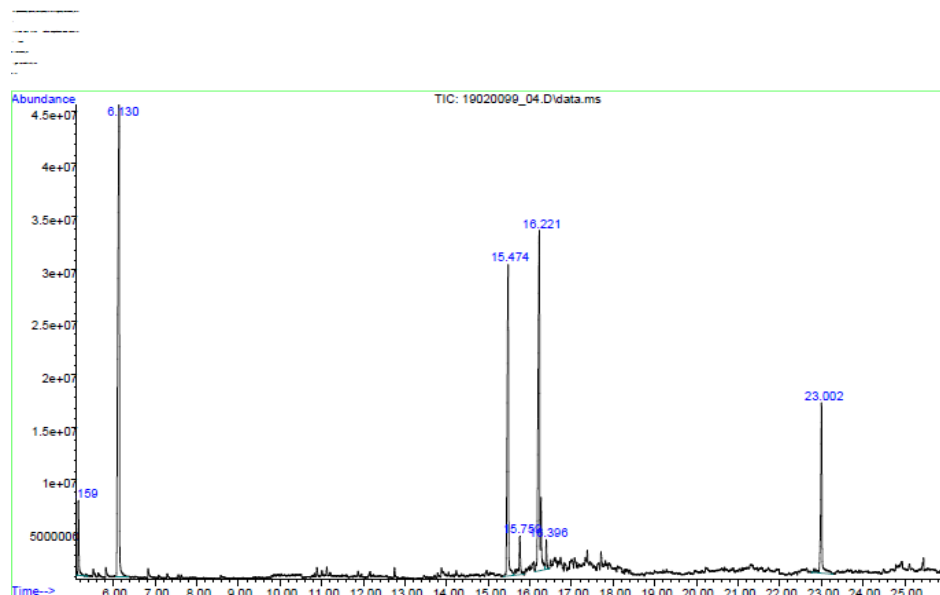
Figures 11(d): Figure shows the GC-Ms analysis of ALHF obtained from PS waste plastics.

g) Physical Properties of ALHF obtained from different waste plastics feedstock:

Table-24 shows the physical properties of the fuel oil produced from various types of waste plastics such as LDPE, HDPE, PP, and PS which were determined using ASTM and APHA. The properties of the fuel oil produced were compared with that of conventional diesel and gasoline. From the results, the density, kinematic viscosity, pH, pour point, cloud point, flash point, fire point and gross calorific value (GCV) were found to be in the range of 0.781-0.792 g/cc, 1.78-1.81cst, 8.20 − 9.0, (+2) − (+4) ℃, (-24) − (-33) ℃, 32-39 ℃, 39-49 ℃ and 9171-10761 kCal/Kg respectively and it is observed that the fuel properties of the obtained ALHF match the properties of petroleum diesel fuels.

Table-24
Physical properties of ALHF obtained from different waste plastic

S.No	Parameters	Protocol	Unit	Present Study			
				LDPE	**HDPE**	**PP**	**PS**
1	Density @ 15°C	ASTM D:1298 – 99 (Reapproved 2005)	g/cc	0.781	0.782	0.789	0.792
2	Kinematic viscosity @ 50°C	ASTM D 445-2006	cst	1.81	1.80	1.79	1.78
3	pH	2110 APHA 22nd EDN 2012	-	8.53	9.0	8.75	8.20

4	Pour Point	ASTM - D 97	°C	+4	+3	+2	+2
5	Cloud Point	2510 APHA 21st EDI 2005	°C	-29	-31	-33	-24
6	Flash Point	ASTM - D 97	°C	39	36	34	32
7	Fire Point	ASTM - D 97	°C	46	39	48	49
8	Gross Calorific Value	ASTM - D 4809	kCal/kg	9171	9716	10761	10429

Conclusion

An investigation of different types of waste plastic feedstocks into aromatic liquid hydrocarbon fuel (ALHF) production had been performed using with a pyrolytic prototype small batch reactor under thermal degradation without using a catalyst. The optimum pyrolytic temperature was maintained at 450ºC and pyrolytic time was 90 min. According to the results obtained, the following conclusions arrived.

i. The effect of process temperature and reaction time on the quality and yield of liquid oil was studied in detail. The optimum conditions for maximum liquid oil yield of 81.6% obtained from waste PS were achieved at 450°C temperature and 90 min reaction time.
ii. The effect of types of feedstock was studied in detail, and the maximum ALHF yield percentage of 81.6% obtained from PS waste plastic, whereas the minimum yield percentage of 58.07% was obtained from LDPE.
iii. Liquid oil (ALHF) yield increases with increasing the pyrolytic time from   60 min to 90 min at a temperature from 350ºC to 450ºC but as the pyrolytic time increases from 90 min to 120 min, the ALHF yield decreases. Whereas, pyrolytic time decreases with an increase in temperature.
iv. The quality of ALHF was studied using characteristic's techniques, according to the results which revealed that the physical properties such as density, kinematic viscosity and gross calorific value (GCV) in the range of 0.781-0.792 g/cc, 1.78-1.81cst and 9171-10761 kCal/Kg respectively are similar to conventional petroleum diesel fuel (ie., density – 0.815 – 0.870 g/cc, kinematic viscosity – 2.0 – 5.0 cst and gross calorific value (GCV) –10,282.7 kCal / Kg).
v. FTIR analysis was carried out for ALHF which reveals the functional groups such as paraffin's, olefins and naphthenes were found and the same is similar to the literature reports.
vi. Hence, the ALHF could be suitable for alternative fuel for transportation and other domestic fuel users and it could be the possible way to minimize the waste accumulation account into deals with the municipal solid waste management since the plastic wastes are the third highest percentile composition in the MSW after the food and paper waste.

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FACTORS INFLUENCING THE SUCCESS OF ELECTRONIC REVERSE AUCTIONS IN PUBLIC PROCUREMENT IN INDIA

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Abstract

The electronic reverse auction (eRA) is used as the price negotiation tool in the procurement function. The eRA is the fairest mechanism in public procurement because it ensures that the economic value goes to the community while eliminating the favoritism and corruption inherent in bureaucratic discretion. In India, public procurement constitutes 30% of Gross Domestic Product (GDP). So there is a lot of potential for savings in public procurement using price negotiation techniques of eRA effectively.Asthere are no guidelines issued by Central Vigilance Commission (CVC) regarding how to conduct eRA event, every organization is using a different methodology for carrying eRA. These organizations revise their methodology based on the experience gained through events conducted over a period of time.The main purpose of this paper is to identify factors influencing the success of eRAs in public procurement in India.

Keywords - Electronic reverse auction, eRA, electronic auction, online auctions, public procurement.

Introduction

Use of eRA as price negotiation tool was started in public procurement in India in early 2000. At that time, there were no guidelines issued by CVC for the conducting eRA event. Subsequently, vide CVC Order no. 46/9/03 dated 11.09.2003, CVC informed that the dept/organizations may themselves decide on e-procurement/reverse auction for purchase or sales and work out the detailed procedure in this regards, it has, however, to be ensured that the entire process is conducted in a transparent and fair manner. (COMMISSION, 1998)Thereafter there is no order/circular specifically for use of eRAs. Most of orders and circulars are issued pertaining to e-procurement only.So there is a need to study eRA practices followed at various organizations for conducting eRA effectively and identify factors influencing the success of eRAs in public procurement in India.

Design/methodology/approach

In this paper, theliterature has been reviewed for identifying factors influencing the success of eRAs in the public procurement process. Literature in the form of tender documents, tender guidelines and tender manuals is also collected from state/central department websites and PSUs

websites.As PSUs are more techno-savvy and more advanced in using the latest technology, eRA practices used by various PSUs are discussed wherever required without revealing their identity.

Discussions

Early literature summarizes several management-related conditions in detail that influence the success of the implementation of eRA process. (Wagner, 2004)The factors relevant to the successful implementation of eRA methodology in the public procurement process in India can be grouped into three categories:

1. Factors related to purchasing management
2. Factors related to eRA process management
3. Factors related to Auction strategy and design

Public procurement in India is mainly regulated by General Financial Rules (GFR) and CVC guidelines. Unlike the private sector, public entities' spending is not fully driven by the bottom line and profit. Instead, their decisions are made based on laws and regulations to maintain fair competition in the market. The above mentioned three categories are discussed with respect to public procurement in India.

1. Factors related to purchasing management

The following factors are related to purchase management, applicable for public procurement.

1.1 Supplier participation in eRA

Research has shown that the wider the field of qualified suppliers, the probability that the reverse auction will produce a successful outcome for the buying organization. The researcher also found that there is a strong correlation between the number of firms bidding and the intensity of competition in the reverse auction. (Wagner, 2004)Many researchers argue that a large number of suppliers should participate in a reverse auction, provided that their bids are independent of each other and that they possess the capability to deliver the product according to the specifications.(Kaufmann, 2004)The competition among a larger number of suppliers is supposed to be stronger. There is no 'right' absolute number, however, at least two competing suppliers (Beall, 2003), minimum three (Mabert, 2002)or a sufficient number of competitive suppliers(Smart, 2002)have been recommended.

1.2 Category of products to be purchased through eRA

A greater part of the literature on eRA recommends the use of this tool for commodity purchasing (Tassabehji, 2006).Although eRA mostly used for commodity products and services, with support, eRAs could also be used for purchasing more complex and strategic commodities (Schoenherr, 2007)The low complexity of these products and services enable easy comparison of the offerings of competing vendors (Losch, 2007)(Smith, 2009).Categorized 'specifiability' as the most important criterion for determining if a reverse auction was appropriate for a particular procurement.The study found that products that require frequent changes in their design and/or components should expressly not to be purchased through competitive bidding due to the problems associated with such items.(Kumar, 2008)The researcher mentioned that eRAs are

applicable to a host of items (products/services) such as stationery items, software licenses, insulators, personal computers, chemicals and plastics, billboards, etc., in sectors such as telecommunications, logistics services, engineering and transportation.(Wagner, 2004).

1.3 Size/volume of auction

From a supplier's perspective, higher auction volumes are more appealing than low volumes (Smeltzer, 2002)(Beall, 2003). Larger lot sizes are associated with lower transaction costs and economies of scale. Also, a supplier's effort to prepare and submit offers has to be justified by a large enough (potential) business. (Kaufmann, 2004)The procurement volume must be sufficiently high to provide sufficient profits to attract enough suppliers and provide buyers with enough savings to cover their additional costs(Shalev, 2010).

2. ERA process management

The following process variables and process controls are related to eRA process management applicable for public procurement and thoseaffect the performance of eRA process.

2.1 Scheduled time of Auction

The scheduled time of auction is important because auction participants may be anywhere in the world, and selecting a time carefully and properly communicating it in advance of the auction event will maximize participation. (Schrader, 2004)Sometimes auction needs to be rescheduled based on the availability of participants.

2.2 Auction Run Time

Auction run timemeans mandatory time period to keep eRA event open for bidding irrespective of bids received or not. Generally, auction run time is kept between30 min to 120 mins. Sometimes due to certain technical constraint, the bidder may not able to login to the system immediately. In this time, the service provider helps bidders to log in to the system. If this time is kept less, then bidder may not get sufficient time to resolve any technical issue if arises and therefore may not able to participate in the event. (Schrader, 2004)This leads to lesser competition. Most of PSUs allow an average mandatory time period of min 60 mins for eRA event.

2.3 Auto Extension Time Period

An auction runs into overtime period whenever any bid is received in the final phase of the eRA (e.g., in the last five minutes) and it may iterate if bidding continues in the previous overtime period. The additional amount of time allows bidders to react to the snipers(A, 2001)and minimizes the potential for pricing rings. (Parante D, 2001), If this time is kept very less, then bidder may not get sufficient time to submit their bid as well as decide their revised bidding strategy based on the response from competitors. One drawback with this arrangement is that it obligates serious bidders to return to the eRA at the end of the process and remain there through the subsequent extension periods.(Ching-Chung Kuo, 2004)The average auto extension time period is allowed as 5 mins. If no of auto extensions of events is kept limited instead of unlimited auto extensions, then auto extension time period allowed is kept on the higher side as the bidder

has to decide their bidding strategy with limited no of bids to win the auction. Few PSU banksallow limited no of bids to all bidders after mandatory Run Time of eRA event instead of unlimited time extensions. This ensures the early conclusion of eRA event.

2.4 ERA Training for Buyer and Supplier

Training is an important phase of successful eRA implementation. Training helps to remove the resistance for use of eRA for the buyer as well as suppliers during the initial stage. The training provides the opportunity to give information related to the use of website and business rules of the eRA event.Nowadays, online Training is given to suppliers by creating demo auction on service providers' website. The main objective of the training is to make the supplier understand the process thoroughly about the usage of the software and various functions. This helps to avoid operational issues related to eRA in advance and also increases the eRA adaptability of the suppliers. (Carter, 2004)(Jap, 2003)

2.5 Use of Proxy biding / Auto bidding

Proxy bidding feature is a pro-bidder feature to safeguard the bidder's interest of any internet failure or to avoid last minute rush. It has been found that most of the complaints received from bidders after eRA are related to internet failure only. This feature definitely helps to avoid legal hassles/complications. Therefore use of proxy bidding need to be pushed and propagated during bidders' training, so that bidders can use this feature confidently. The proxy feature allows bidders to place an automated bid in the system directly in an auction and bid without having to enter a new amount each time a competing bidder submits a new offer. The bid amount that a bidder enters is the minimum that the bidder is willing to offer. Here the software bids on behalf of the bidder. This obviates the need for the bidder participating in the bidding process until the proxy bid amount is decrementally reached by other bidders. When proxy bid amount is reached, the bidder (who has submitted the proxy bid) has an option to start participating in the bidding process. (Supat Petchbordee, November 19-20, 2005)

2.6 Seamless integration of e-tendering system and eRA system

Seamless integration (R. Towill, 1997)is required between the e-tendering system and eRA system for maintaining confidentiality during the entire tendering process. Complete procurement details can be made available to the bidders after finalization of the tender to maintain transparency as per CVC guidelines. Otherwise, in case of separate systems, bidders have access to price comparison statement of all techno-commercial acceptable bidders through e-tendering portal and as bidders have a chance to revise their prices in the bidding process, like-minded bidders can collude themselves and manage the final result of eRA in their favor. Therefore most of the PSUs are using a single service provider for e-tendering as well as eRA.

3 Auction strategy &design

Elmaghraby defines various auction formats and also addresses issues related to constructing or bundling of lots, types of feedback to be provided to bidders during the auction and the type of bid format to use. (Elmaghraby, 2007)Careful preparation of the event (auction strategy)

including equal treatment to all participants and effective communication are key factors for obtaining benefits from eRA (Losch and Lambert, 2007).

The following are key parameters of the auction strategy & design.

3.1 Auction Formats

There are four types of eRA formats based on a combination of auction termination and decision criterion. i.e. reverse English, reverse Vickrey, reverse Dutch, and reverse Yankee. Reverse English is the most commonly used eRA formatwhere each seller offers the price at which it is willing to sell an item to the buyer. At the end of the auction, the item is purchased from the lowest bidder at its bid price. This kind of eRA can involve a single product or multiple products and the buyer may be allowed to specify a "reserve price," which is the highest price the buyer is willing to pay for the requested product. Reverse Vickrey (or second price) is similar to reverse English except that the lowest bidder sells the product at the price offered by the second lowest bidder. Sellers taking part in this type of event have the incentive to bid what they think the item is worth without worrying about what other participants will bid. Vickreyhas shown that the buyer will ultimately save more money if the lowest bidder is paid the second lowest price instead of the lowest one. (Vickrey, 1961) Reverse Dutch is designed for the situation where a number of identical items are wanted. The buyer typically specifies the start bid as well as the exact number of items that it wishes toacquire at that maximum price. The sellers then bid at or below that level for the number of items that they are interested in selling. In the end, the lowest bidders earn the right to sell those items at the lowest successful bid price. Finally, reverse Yankee is a variation of reverse Dutch. In this case, successful bidders sell what they bid as opposed to selling at the price determined by the lowest bidder.Almost all PSUs are using Reverse English auction format only. (Ching-Chung Kuo, 2004)

3.2 Start Bid Price

The start bid price is an important parameter in conducting eRA effectively. If the start bid price is selected very low, then bids may not be received during eRA event and therefore eRA event need to be re-conducted. (Beall, 2003)And if the start bid price is selected very high, then the time required to conclude the eRA will be high. Therefore start bid price is to be selected properly.Some of the PSUs are opening sealed price bid submitted along with an un-priced techno-commercial bid for deciding Start Bid Price. The start bid price for eRA is taken as lower of a) Lowest sealed bid and b) Estimate. Few PSUs are inviting online sealed bid before conducting eRA instead of opening sealed price bid submitted along with an un-priced techno-commercial bid for deciding Start Bid Price. The start bid price for eRA is taken as lower of Lowest online sealed bid and Estimate. (BHEL, 2016)Some of the PSUs are considering estimate with certain % deviation. (CIL - Guidelines for e-procurement for Works and Services)

3.3 Decrement

Bid decrement can be specified in percentage terms or in monetary value. (Ching-Chung Kuo, 2004)Determining the right bid decrement is extremely important to the success of an event. A too-large bid decrement will prevent sellers from bidding and thus reduce competition. Also, when there is a wide range in the price of the line items, decrement in percentage is used instead

of a monetary amount. Decrement decides time required for concluding the event. In the case of small decrement, no of bids received in the event RA will be more and time required for concluding the event is more. Most of the PSUs are considering decrement as 0.1% or 0.5% of the start bid price. Normally the reduction is made as per decrement value or in multiple thereon. The maximum seal percentage in one go is fixed at a certain percentage over and above the normal decrement of the start bid or last quoted price during the reverse auction, whichever is lower. This prevents bidders to offer absurd bid during the event or any typographical error.

(CIL - Guidelines for e-procurement for Works and Services)

3.4 Price visibility

On the basis of information transparency, an eRA falls into one of two categories: open bid and sealed bid. With an open bid, information on all of the bids, or the lowest bid, or the bidder's own ranking is revealed in real time, but the identity of bidders is not disclosed throughout the auction process. Based on visibility and disclosure rules, eRA is also classified as Rank and L1 bid auction and Rank the only auction. (Carter, 2004)(Kumar S., 2007)

Rank and L1 bid auction

In this type of auction, Bidders can see their bid along with the leading bid and their rank. This type is most effective in auctions driven by price/market share. These are useful for a category that is commoditized and competitive. In this type of auction, price as a key factor in the award decision. Most of the PSUs are using this formal for all types of eRAs.

Rank only auction

These auctions are the most suitable when the bid values have a large spread and procurement of value-based categories. These auctions are useful for supply market sensitive to price disclosure and price as a weighted factor in the award decision. (SAP, 2006)Very few PSUs are using this format in case of a certain category of items.(BHEL, 2016)

3.5 Lot bidding strategy

Bidders compete on prices per line item in auction or on a group of line items, called a lot. Lots force suppliers to bid on all the line items in a lot.

Line item bidding

A line item is an individual item on which the suppliers can bid. Bidders enter the price per line item. This type enables the buyer to cherry-pick on a line-item basis to come up with the lowest award mix; however, note that suppliers can also then cherry-pick which items on which to bid. This type provides more visibility into Pricing and mostly used when the buyer is unsure of volume demand.

Lot bidding

A lot is a grouping of line items, based on delivery location, raw material, manufacturing processor award strategy. Bidders enter the priceper line item for each item in thelot; the application calculates theextended value (price multipliedby quantity) and uses the extended

value for visibility and bid decrement rules.This enables the buyer to get bids on low-margin or low-volume items on which suppliers might not bid if the items were listed individually This also enables the buyer to consolidate the supply base and used only if the volumes indicated for bidding are actual volumes, not estimates, that will translate into award volumes.(Carter, 2004)(SAP, 2006)

Research gaps

There is only one paper found on electronic reverse auction and the PSUs. (Shalev, 2010)This research paper examined the factors which could affect the success ofe-RAs in public sectorresearch. Their findings indicated that competition among suppliers, the complexity of the purchase, and how well the purchase was specified were the factors which were most strongly correlated with e-RA success. These factors are purchasingmanagement related conditions only. The other issues (i.e. theauction design and the ERA process) have not beenstudied in detail, even though, these factors certainly have someimpact on the success of an eRA.Few researchers has proposed that research may be carried out using specific cases to study eRA practices at firm level in detail. (Srivastava, 2012)It may be worthwhile to investigate on a pattern of about how eRA practices differ across firm size (Dawn H. Pearcy, 2008)Use of third-party portal or conducting eRA in-house may also be studied in detail.Therefore an empirical study of eRA practices followed at various depts/organizations pertaining to public procurement will add to academic discourse.

Conclusions

As the eRA is the fairest mechanism in public procurement, nowadays the eRA is more frequently used as the price negotiation tool.It ensures that the economic value goes to the community while eliminating the favoritism and corruption inherent in bureaucratic discretion.As there are no 'right' absolute numbers of techno-commercial acceptable bidders required for carrying eRA successfully, PSUs go for eRA if techno-commercial acceptable bidders are more than equal to 2 to 4 bidders. However, it has been noted that their eRA process is designed in such a way that confidentiality about bidders' identity is maintained. This helps to maintain the intensity of competition even in case of less no of bidders are available for bidding during eRA. PSUs use eRA tool in case of a standardized or commoditized product and where specifications are clearly spelled out and measured. The basic objective is that even though prices go down during eRA, the supplier cannot supply substandard quality of material to mitigate their losses. PSUs procure common raw material/packing material/general material/consumables centrally to take advantage of higher savings through auctions due to higher volumes. an eRA is normally scheduled with the optimum run time period and auto extension period so that maximum bidders can participate in the event. Training to buyers & suppliers helps to avoid operational issues related to eRA in advance and also increases the eRA adaptability. In order to avoid legal hassles/complications during eRA event, use of proxy bidding/auto bidding needs to be pushed and propagated during suppliers' training to safeguard their interest in case of any internet failure. Seamless integration is required between the e-tendering system and eRA system for maintaining confidentiality during the entire tendering process so that the possibility of collusion between suppliers can be avoided. Usage of different

eRA formats with optimum start bid price anddecrement, the correct setting of price visibility & lot bidding strategy during eRA event is very much useful to manage eRA event effectively. So there is a need to study eRA practices followed at various PSUs to consolidate the experience of conducting eRA effectively with different eRA process parameters and auction design.

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ROLE OF NGO'S IN RURAL DEVELOPMENT IN RAJASTHAN:A SPECIAL EMPHASIS ON EDUCATION

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Abstract

The aim of the study was to learn about the role and function of NGOs in rural development, with attention to education. In this study, data was collected on several NGOs working in different districts of Rajasthan. The various NGOs were randomly selected from the 33rd district of Rajasthan. NGOs in rural areas were mainly dedicated to the environment, to the promotion of women, to health, but most of them are educational institutions. Many NGOs such as Bodh, Diganter, Kalp, SevaMandir, PrathamPahal, AjimPrem G Foundation, DushraDashak and Jksms are working very well in Rajasthan. BGVS (Bharat Gyan Vigyan Samiti) is mainly involved in the campaign for the right to education (RTE). NGOs like Bodh and Diganter deal with upper secondary education in rural areas of Rajasthan, particularly in the Jaipur district. Now they are training public school teachers on how to deal with children from NGO schools. Non-governmental organizations (NGOs) and voluntary actions have been part of the historical heritage. At the beginning of the 20th century, various voluntary efforts were initiated in the fields of education, health, etc. NGOs became important after independence, especially after the 1970s.

1. OVERVIEW

NGOs are hard to define, and the expression "NGO" is once in a while utilized reliably. Subsequently, there are various orders being used. The most widely recognized methodology is "manage" and "operational dimension". The introduction of a NGO alludes to the kind of movement it completes. These exercises may incorporate human rights, the environment or development work. The dimension of activity of a NGO shows the scale in which an organization works, for example, nearby, local, national or global. The expression "non-governmental organization" was first instituted in 1945, when the United Nations (UN) was made. The UN, thusly an intergovernmental organization, has made it feasible for some endorsed non-state particular global agencies, ie non-governmental organizations, to pick up onlooker status in their congregations and at a portion of their gatherings. Later the term was utilized all the more broadly. Today, as indicated by the UN, any sort of private organization autonomous of government control can be called a "NGO", if it is a non-benefit, non-criminal gathering and not just a political resistance.

In India, the motivation behind development isn't constrained however expansive, since it incorporates financial development, yet additionally social development, personal satisfaction, strengthening, the development of ladies and kids, instruction and familiarity with its natives. The development task is so

huge and entangled that the execution of government plans isn't adequate to take care of the issue. To accomplish this objective, an all-encompassing vision and community-oriented endeavours with different offices, agencies and even with NGOs is required. In light of this extraordinary need, the quantity of NGOs in India is expanding quickly, and, at present, there are somewhere in the range of 25,000 and 30,000 NGOs dynamic in India. NGOs or non-governmental organizations have more noteworthy advantages from working in rustic regions than government organizations since NGOs are progressively adaptable, NGOs are explicit to a specific area and, also, are focused on serving the general population and the network on the loose. the assignment of development is huge, numerous NGOs assume an imperative job in the rustic development of India as a team with the government. Rajasthan is the biggest state in India as far as absolute region involved. The state likewise has a critical diversity of land, a model of sustenance, just as a model of scattering of lodging in provincial territories and fundamentally a bone-dry state with little to direct precipitation and, along these lines, regularly with states of starvation. The correspondence arrange is rare and climatically has an extreme summer, notwithstanding a brutal winter atmosphere. The investigation on the job of NGOs in provincial development has verified more noteworthy significance in the ongoing past considering the disappointment of top-down and welfare-situated ways to deal with rustic development programs.

2. OBJECTIVES OF THE STUDY

The goal of the investigation is to archive the job and commitment of certain NGOs in essential education. While NGOs are better connected with little projects and small-scale level interventions, the point is to research how NGOs can bolster and improve national-scale educational projects and collaborate with the government in a more extensive large scale environment. The essential reason is that the objective of universalizing rudimentary education can't be accomplished in the present moment with government exertion alone and that enduring and enduring connections with NGOs will help accomplish these objectives. The examination tries to outline the relative favorable circumstances that NGOs can convey to vast scale educational projects and projects. Its goal is to investigate the nature and effect of the coordinated effort of the NGOs met with the government, to help a more grounded job for NGOs. Investigate the chances and restrictions of extending the NGO's innovative activities in general education. The study requires increasing participation and association for NGOs in primary education in Rajasthan.

The following are the specific objectives of the Study.

1) To study the NGOs work in the upliftment of rural areas of various districts in Rajasthan.
2) To explore the special emphasis on education sector.
3) To Study the various problems faced by the NGOs.

3. SCOPE OF THE STUDY

The main scope of the study was the role and functions of NGOs in rural development. The study was exploratory and descriptive. The organization that is registered under the company deed and the trust deed

has been covered. Through this study, it is possible to learn about the work done by NGOs in the revolt of the rural areas of the various districts of Rajasthan. A special emphasis has been placed on the education sector.

4. METHODOLOGY

This section is dedicated to the formulation of objectives, the planned research, the selection of samples and the construction of research tools, the collection of data and their methods of analysis. Literature reviews, personal consultations and discussions with various professionals and NGO officials led to the next phase of goal formulation, which is considered a central step in any research attempt.

The exploratory design was selected due to the nature of the problems, the respondents and the type of question that arose to generate data. The nature of the data obtained for the present study is of a qualitative nature. The study was based on primary and secondary data, but the primary data was taken as the main basis of the entire analysis. The main source consisted of interview programs taken by the secretaries or by the head of the NGOs and by the selected beneficiaries. Secondary data include several published books, reports, diaries and official reports, while the secondary data source was compiled by the Ministry of Human Resources Development, the Ministry of Social Welfare, the Ministry of Foreign Affairs, the Internet and the NGOs.

The main objective of the study was to know the role and function of NGOs in rural development. Therefore, the sample represented NGOs working in rural areas of thirty-three districts of Rajasthan. NGOs were randomly selected from 33 districts of Rajasthan. The "no. Of the NGOs contacted, there were 60, of which only 30 responded voluntarily.

5. FINDINGS & DISCUSSION

In this study, data was collected on 60 NGOs working in different districts of Rajasthan. The 60 NGOs were randomly selected from the 33rd district of Rajasthan. One of the main difficulties in collecting data was that some NGOs moved to other locations from their registered address. Even some of them were not an existence. Of several selected NGOs, only 30 responded in solidarity. NGOs like Bodh, Diganter, Kalp, SevaMandir, PrathamPahal, AjimPrem G Foundation, DushraDashak and JKSMS are certainly working very well in Rajasthan. The other NGOs simply filled out the questionnaire and did not reply with further information. The NGO that voluntarily accepted a meeting offered its support during the interview. They talked about their establishment, their working methods; problems faced by them, but were rather conservative in aspects of the organization's financial aspects.

NGOs in rural areas were mainly dedicated to the environment, the promotion of women, health and education. Many organizations work for AIDS. 70% of the NGO response was funded by the government. and only 20 NGOs worked perfectly with the members' funds. Organizations such as JKSMS (Jan kalasahitya munch sansthan) have been funded by UNISCO for the education of street children in Jaipur

and nearby cities. JKSMS-funded library support program funded by EE. UU. It was noted that they were more satisfied with working with foreign donors and only 15% of them seemed to be happy to work with the government ... All the NGOs interviewed felt that the work culture was good in foreign countries. They were not happy with the government's response. officials In turn, the government. officials complained that all these organizations were making money and even suggested that it was not possible to research them.80% of the NGOs interviewed were supported by other NGOs. Some of the organizations were fermented in the early stages by these supporting NGOs. These NGO support organizations were an additional way to orient for these organizations and even worked together on specific projects. They shared a good reputation with other NGOs, especially working in the same district, and even carelessly worked on some important issues such as water conservation.

Even the main foreign NGOs are working at the central level of Rajasthan. They work in collaboration with local NGOs and help them work efficiently. The villages covered by NGOs selected for development have been taken. The number of beneficiaries was 15 each from 20 villages and 250 of the 300 beneficiaries responded. It turned out that they knew about education and health but did not rely on these topics. Even so, they were too rigid to follow. Although they know the value and importance of education, they do not want to educate the elderly and women.

NGOs in India

Since antiquated occasions, social administration has been an indispensable piece of Indian culture. Not long after independence, a few NGOs rose in India. Mahatma Gandhi is additionally announced to break up the Indian National Congress and transform it into a LokSevaSangh (Public Service Organization). In spite of the fact that his solicitation was rejected, however devotees of Mahatma Gandhi started many volunteer agencies to deal with different social and monetary issues in the nation. This was the main phase of NGOs in India.

The second phase of NGO development started in 1960, when it was viewed as that just government programs were not adequate to finish the development task in provincial regions. Numerous gatherings were framed whose job was to work at the essential dimension. In addition, good government policies have definitely influenced the development of non-governmental organizations and their jobs around then. Throughout the years, the job of NGOs in country development in India has expanded. Indeed, even today, their job changes altogether with the adjustment in government policies crosswise over various plans.

6. MAJOR ROLE SEEN FOR NGO'S IN RURAL DEVELOPMENT AND UEE IN RAJASTHAN

While economic change and liberalization have seen the government free a few zones to permit the pioneering soul of the private segment to thrive and add to the high rate of economic development as of late, a comparable change in outlook is expected to swing to NGOs of its reliance on help and outside

gifts to transform the nation's provincial situation. This ought to be accomplished for NGOs through their participation in miniaturized scale fund, smaller scale protection and smaller scale undertaking exercises for the general development of country territories and to advance the prosperity of the provincial populace of India.

NGOs are dedicated to health, family planning, women's empowerment, but most of them are educational institutions. Credit for the increased literacy rate in rural areas is given to these organizations. Child marriage still prevails in the villages. Not much has been done in this area, the work has been done for women's empowerment. Thought towards women has changed. NGOs generally depend on the government. Schemes or sources of foreign financing. Since they did not provide clear information on the allocation of funds, it was not possible to access the correct use of the funds. It looks like they used development funds, but they might not be up to it. They have come a long way; the first type of sacrificial voluntarism is lost. They have become more professional. They worried about rural development; They consider it more a job than serving the country. They have a simple lifestyle but are not accepted as a previous method of social service.

The voluntary activity invigorated and advanced by the voluntary agencies engaged with development assumes a significant job at the essential dimension in the Indian social environment; The achievement of rural development relies upon the dynamic participation of individuals through self-improvement organizations. The diverse elements of the NGOs are: to catalyse the rural population, construct models and investigation, incorporate the government's endeavours, arrange the rural poor, instruct the rural population, give training, disseminate information, mobilize resources, advance rural administration, speak to the population rural, go about as trailblazers, guarantee prevalent participation, advance fitting advances and initiate the rural conveyance framework. The boundless conviction that NGOs are increasingly effective in achieving the poor in neediness decrease additionally has fast development in financing for NGOs by government and outer givers. With respect to government subsidizing, there are numerous government plans started by local and state governments through which NGOs can have direct resources for rural development.

Universalization of Elementary Education (UEE): literacy Status of Rajasthan

The universalization of essential education (EEU) in India remains a far off point of view. The measurements of this ineffective are notable. Half of women and right around 33% of men are uneducated. There are extraordinary variations in the dimension of education among states and between the genders. While the frequently refered to province of Kerala has achieved practically all out literacy, the pockets of Rajasthan have female literacy rates as high as 14%, which speaks to a genuine test to the social and economic development process. Bihar and Rajasthan have the most minimal literacy rate for grown-up women of 27%. While the gross enrolment record (GER) in the nation rose to 90% in 1997-98, the net enrolment rate (NER) is just around 60.3%. The employment rate of girls is 48.8%, over 22%

lower than that of children. The most exceedingly awful gender differential is acquired in Rajasthan, where the NER for girls is 47% lower than that of boys. The 35-year-olds in the age bunch somewhere in the range of 6 and 11 in the nation were out of school in 1997. A normal of just about a fourth of the children took a crack at the evaluation reiteration classes. India is along these lines confronting difficult issues of deficient access, quality and wastefulness in the school system.

Role of Bodh Shiksha Samiti in Rajasthan

Bodh Shiksha Samiti started his work during the 1980s in the ghettos of Jaipur, Rajasthan, to give satisfactory education to children having a place with socially minimized gatherings. A large portion of the ghettos had no school. Government schools, where they existed, did not give a satisfactory learning environment to these children. Bodh has assumed the undertaking of "growing such instructive practices and procedures that empower children to get satisfactory, fair and quality education dependent on network participation and initiatives". Bodh is designated National Coordinator for the Central Group for the Education of the Urban Poor. The Department of Education is additionally an individual from this principle gathering. The model of network schools in Bodh rehashed in a joint initiative of United Nations agencies for legitimate education for the poor of the urban areas in Jaipur and the remainder of the urban zone of Rajasthan.

7. CONCLUSION

This study depended on the elements of NGOs, including financial changes of the villagers, health and sanitary conditions, economic security, education and the circumstance of independent work. Nonetheless, this study additionally underlines that expecting radical social change through voluntary exertion is likewise a kind of fantasy and includes that the financial structure and inspirational frames of mind towards NGOs likewise add to their developing job in the process of development. Along these lines, NGOs can bring issues to light among the rural poor. Presently both society and the country are expected to make these rural regions and the skilled individuals know their fundamental rights. NGOs are the main organizations that could build up the rural region.

Most recipients, non-recipients, NGO specialists and laborers from other development agencies have considered the rural development works of successful NGOs for rural development. Studies uncover that NGOs can play a fundamental job in development. The job of the state in the planning process, political parties, participation, the dynamic participation of grassroots organizations, the job of benefactor agencies, and so forth they are significant for guaranteeing individuals' participation and the financial development of individuals. The annihilation of poverty, the development of HR, health care, the protection of the environment, the protection of human rights, the liberation of women, children and the weakest sections, the beginning of the silent Revolution, etc. .

In general, NGOs operate in urban areas thanks to the easy availability of basic facilities and infrastructures. NGOs operating in rural areas are working centrally, but those with offices located in urban areas and working for rural development do more work. They hesitate to provide us with information.

After visiting many NGOs, I realized that the funds were not used correctly as shown in the newspaper because every time they were asked to talk to the students, they heard a new excuse from them. Many NGOs such as Bodh, Diganter, Kalp, SevaMandir, PrathamPahal, AjimPrem G Foundation, DushraDashak and JKSMS undoubtedly work very well in Rajasthan. BGVS (Bharat Gyan Vigyan Samiti) works in neighbourhoods like Baran, Dholpur, Bundiand Pali. It is primarily about the right to education campaigns (RTE). NGOs like Bodh and Diganter deal with upper secondary education in rural areas of Rajasthan, particularly in the Jaipur district. Now they are training public school teachers on how to deal with children from NGO schools. Many NGOs are led by ministers or family members of bureaucrats.

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SMART CAR PARKING AND MANAGEMENT SYSTEM

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Abstract—Parking a vehicle is something an average human does on daily basis. With the growth and development in modern cities, urbanization and betterment in the standard of living of people, parking a vehicle is an issue which needs attention. The purpose of developing this system is to propose a solution that is easily accessible and can benefit a user at upfront. Systems like this do exist but still, as a normal resident of a growing city, we still feel the problem. This system is designed in a way to not only assist a person find a parking space but also can add value to their experience while visiting a number of places. The zeal to take such a problem comes from the pain which a normal human faces every time he/she visits a place. The concept of this is whenever a person wishes to travel to a place with family members, they feel a better experience and enjoy the time which is the real essence of life of a human being.

Keywords— Urbanization, Easily accessible, Assist, Better experience

I.   Introduction

With the increase in the standard of living of people, presence of a vehicle in every house is a common thing. In modern towns and cities, problem of traffic and available parking spaces is quite frequent. Finding a proper place for parking a car not only takes time of a person , increases consumption of fuel and may even lead to minor/major accidents. With the advancement in technology and growth of sciences in automobile industry, smart car parking is an area of research. It not only eases the process of finding a parking space but also provides a better user experience.

With the growth in automation, systems consisting of automatic sensors are being developed that sense directions as well as position of vehicle and obstacles. Existing systems face problems like less of intelligence, user friendly interface or ease of availability. Systems that are easily available, accessible and provide better user experience must be developed. Following the future technologies and the way in which humans and machines will interact in future, systems must be developed that can walk hand in hand with time and hence provide a better user experience.

Related Work

Technical developments have lead to many kinds of gadgets. Low cost sensors, Wireless machinery and use of automation technology gives more power to make our systems better. A

project was carried out by Georgia Institute of Technology. The project used technologies like satellite imaging, mobile application for parking management systems. Using Fiber Braggs Grating sensors embedded in ground, sensing pressure of car tyre to detect the presence.

The common goal for the systems is to provide car drivers assistance and provide them ease every time one goes out.

Just Park, originally known as Parkatmy House, was founded by Anthony Eskinazi in September 2006 after he had trouble parking for a baseball game in San Francisco. In July 2011, the company raised venture capital from BMW Ventures, the venture capital arm of BMW, In January 2012, they launched a beta version.

II. literature survey

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III. System overview

The user, or rather a new user is provided with a feature to create a personal account by filling a small form of obvious information in the form of text fields. Also, the account of the user is secured by a password. For existing user, feature of sign is available. Where the user can directly enter the system and use the features. Multiple options are available i.e a number of places are available where parking spaces are available. User can view the options and book a slot accordingly. The booked slot and other slots can be viewed by admin view of the system. The admin view can be used to handle the application and modify the services available. Adding or removing options can be done from the source code itself. Auto update on completion of a service is provided so to reduce the effort of admin.

IV. software design

The user, or rather a new user is provided with a feature to create a personal account by filling a small form of obvious information in the form of text fields. Also, the account of the user is secured by a password. For existing user, feature of sign is available. Where the user can directly enter the system and use the features.

Multiple options are available i.e a number of places are available where parking spaces are available. User can view the options and book a slot accordingly. The booked slot and other slots can be viewed by admin view of the system. The admin view can be used to handle the application and modify the services available. Adding or removing options can be done from the source code itself. Auto update on completion of a service is provided so to reduce the effort of admin.

V.   future scope

Voice technology being the new interface in future, will become a daily routine for a human to ask his/her car to find and book a parking space on its own. It would be extended to the large-scale environment such as corporate buildings, shopping malls and multi-level common parking spaces etc. Nowadays due to busy lifestyle people are not able to concentrate on small things which create irritation and may even panic a situation. Hence it's important to think for solutions of such problems that are small, but can create a great impact.

VI.   conclusion

Addressing a problem that is not that recognizable in day to day life of humans but can create a great impact in providing a better user experience must be considered. Parking a car may seem to be a small problem but with the advancements and betterment in the living standards of people, modern cities face this problem. Also, car parking can be leveraged to a variety of features that can improve user experience every time one goes out.

Technological advancements like voice technology(people talking to their car), analytics in finding usage of resources like parking space and automation a related to auto booking of space will add value to the way humans conduct their day to day activities.

Hence problems like this that are not usual but can be used as a platform to provide betterment in society must be taken up so that we as users can have an enhanced user experience.

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ENTREPRENEURSHIP DEVELOPMENT OF RURAL WOMEN THROUGH MICRO FINANCE (SHG'S)

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Abstract:

Micro finance plays a vital role towards the development of rural women in all the aspects of their life. it acts as a catalyst towards the local economies and a huge percentage of micro entrepreneurs in developing countries like India. SHG's payed the way for the economic independence of rural women. Entrepreneurship is the dynamic process through which new enterprises will be emerged. This paper deals with the motivationalfactors that influence the rural women towards the entrepreneurship activities and problems faced by the rural women entrepreneurs   in running the business. A pilot study was done with 30 entrepreneurs in Tirupati rural area. Simple convenient sampling technique was used to collect the data.

Key words: Micro finance, SHG's , Rural Women, Entrepreneurship.

Introduction:

Micro fiancé has emerged as a tool for elevating poverty among rural women by empowering them towards entrepreneurship development with the help of SHG's. in India Micro finance is mainly dominated with the Self Help Group's (SHG's) Bank Linkage Programme. The purpose of the this programme was to provide cost effective mechanism for providing financial assistance to the poor section of the society.

The concept of SHG's is the most important aspect under the Microfinance which serves as a means to empower rural women towards the entrepreneurship development by self employment activities by micro savings, micro credit and micro insurance. Micro finance is also known as micro credit means making provision for smaller working capital for self employment.

Entrepreneurship is a dynamic and innovative process where a new enterprise was created. Entrepreneurship among women is the current aspect where women is coming forward to start business and especially the rural women who are empowered to start micro enterprises with the help of micro credit provided by the SHG's . the first prime minister of India state that " when women moves forward, the family moves, the village moves and the country moves".

Rural Women Entrepreneurship:

SHG's have paved the way for economic Independence of rural women by involving them in Micro entrepreneurship. Micro enterprises not only increase the National productivity, employment but also increase the economic independence personally and social capabilities among the rural women.

Review of Literature:

An attempt was made to study "The Impact of Microfinance Banks on women Entrepreneurial Development in Metropolis" with an objective of Microfinance Banks in contribution towards women economic and financial sustainability by **Fatima.I.Abdulkadir, Salisaumar, Bashir Garba, SH Ibrahim** with a sample of 140 women entrepreneurs. It was found that the concept of MFB has bought tremendous improvement to small and Medium Women Entrepreneurs. The present study suggests that the MFBs should increase their campaign programmes to encourage the participants from individuals, governments and other foreign bodies.

A study was done by **Vijaya Kumbhar** on 'Some critical Issues of Women entrepreneurship in Rural India' with an objective of identifying the issues of women entrepreneurs and problems of entrepreneurs and found that there is a need of continuous attempt to encourage, cooperate, inspire the women entrepreneurs and awareness programs should be conducted by the government.

An analysis was done by**Dr.Ajaysharma,MSSwpnaDua, Mr.VinodHatwl** on ' Micro enterprise Development and Rural Women entrepreneurship : way for economic empowerment' which deals with an objective of building women empowerment and challenges and opportunities for rural entrepreneurs. It was founded that there are several schemes that make rural women can make use of and they have suggested to improve the implementation of these schemes effectively.

A study was done on 'Rural women entrepreneurship A managerial perspective' by**A.Ambiga and M.Ramaamy**. The study was conducted on 450 women entrepreneurs of two districts of Chennai with an objective of analysing socio economic empowerment and problems faced by women entrepreneurs

Objectives of the study:

1. To Analyse the motivational factors for starting an enterprise by rural women in
2. To identify the problems faced by women in starting and running the enterprise.
3. To give suggestions where ever it is needed.

Research Methodology and sampling technique:

A structured questionnaire was distributed to rural women entrepreneurs in Tirupati rural with a sampling technique of convenience sampling method with a sample size of 30 micro women entrepreneurs as a pilot study for my research. Percentage method was used to analyse the data.

Limitations of the study:

1. Time is one of the major constraint in collecting the data.
2. The sample size is the constraint as it can not represent the entire population.
3. As the research is on rural women entrepreneurs where there is some problem of getting biased information.

Data analysis and interpretation:

Part-1: Demographic profile of the respondents.
Frequency Table

Age of the respondent		
	Frequency	Percent
Below 30years	10	33
31-40years	9	30
41-50years	9	30
50-60 years	2	7
Total	30	100

From the above table it is inferred that 33% of the respondents are below 30 years and 30 % of the respondents are between 31-40 years and 41-50 years and only 7% of the respondents are between 51-60 years.

Marital status of the respondent		
	Frequency	Percent
Married	22	73
Unmarried	5	10
Divorced	0	0
Widow	3	10
Total	30	100

From the above table it is interpreted that 73% of the women entrepreneurs are the married women and 10% are unmarried and 10 % are widow.

Educational qualifications of the respondent		
	Frequency	Percent
Illiterate	12	40
Below SSC	8	27
SSC	5	16
Inter/Diploma	2	7
Degree	3	10
Total	30	100

From the above table it is inferred that 40% of the respondents are illiterate 27% are below ssc, 16% are SSC 7% are inter/diploma holders and 10% Degree holders.

Caste of the respondent		
	Frequency	Percent
Hindu	22	74
Muslim	5	16
Christian	3	10
Total	30	100

From the above table 74% of the respondents belong to Hindu 16% Muslims and 10% cristians

Type of family		
	Frequency	Percent
Joint family	7	23
Nuclear family	23	77
Total	30	

From the above table 77% are Nuclear family and 23% are Joint Family

Suggested to join in Self help groups		
	Frequency	Percent
Self	12	40
Family	7	23
Group Members	3	10
Neighbours	8	27
Total	30	100

From the above table it is interpreted that 40% of the respondents respond that they have joined the SHG by self 27% by neighbours 23% by family members and 10% by group members.

Purpose of joining in Self help groups		
	Frequency	Percent
Economic development	8	27
Self-Employment	14	47
Meeting home needs	3	10
All of the above	5	16
Total	30	100

From the above table it is interpreted that majority of the respondents joined SHG's for the economic development and self employment. Only 10% of the respondents joined for meeting home needs and 16% for all the above.

Part-2: Motivational factors of rural women entrepreneurs

To overcome unemployment problem		
	Frequency	**Percentage**
Strongly Disagree	1	4
Disagree	4	13
Neutral	5	16
Agree	8	27
Strongly Agree	12	40
Total	30	100

From the above table it is interpreted that they strongly agree with motivational factor to overcome unemployment problem is 40% Agree 27% Neutral 16% Disagree 13% and Strongly Disagree 4%.

To gain Social status		
	Frequency	**Percentage**
Strongly Disagree	0	0
Disagree	1	4
Neutral	5	16
Agree	10	33
Strongly Agree	14	47
Total	30	100

From the above table it is interpreted that they strongly agree with motivational factor to gain social status is 47% Agree 33% Neutral 16% Disagree 4% and Strongly Disagree 0%

To Lead Independent life		
	Frequency	**Percentage**
Strongly Disagree	3	10
Disagree	2	7
Neutral	7	23
Agree	10	33
Strongly Agree	8	27
Total	30	100

From the above table it is interpreted that they strongly agree with motivational factor to lead independent life is 27% Agree 33% Neutral 23% Disagree 7% and Strongly Disagree 10%

To protect family from economic crisis		
	Frequency	**Percentage**
Strongly Disagree	2	7
Disagree	3	10
Neutral	5	16
Agree	8	27
Strongly Agree	12	40
Total	30	100

From the above table it is interpreted that they strongly agree with motivational factor to family from economic crisis is 40% Agree 27% Neutral 16% Disagree 10% and Strongly Disagree 7%

Utilization of Government Schemes and Assistance		
	Frequency	**Percentage**
Strongly Disagree	0	0
Disagree	1	3
Neutral	5	17
Agree	12	40
Strongly Agree	12	40
Total	30	100

From the above table it is interpreted that they strongly agree with motivational factor to utilisation of government schemes and assistance is 40% Agree 40% Neutral 17% Disagree 3% and Strongly Disagree 0%

Employment generation to others		
	Frequency	**Percentage**
Strongly Disagree	1	3
Disagree	1	3
Neutral	6	20
Agree	12	40
Strongly Agree	10	34
Total	30	100

From the above table it is interpreted that they strongly agree with motivational factor for employment generation to others is 34% Agree 40% Neutral 20% Disagree 3% and Strongly Disagree 3%

Part:3: problems you faced while running an enterprise

Lack of entrepreneurial skills		
	Frequency	Percentage
Strongly Disagree	1	3
Disagree	2	7
Neutral	10	34
Agree	8	26
Strongly Agree	9	30
Total	30	100

From the above table it is interpreted that they strongly agree with problems they faced by running the enterprise by lack of entrepreneurial skills is 30% Agree 26% Neutral 34% Disagree 7% and Strongly Disagree 3%

Competition in the market		
	Frequency	Percentage
Strongly Disagree	1	3
Disagree	2	7
Neutral	5	17
Agree	12	40
Strongly Agree	10	33
Total	30	100

From the above table it is interpreted that they strongly agree with problems they faced by running the enterprise by competition in the market is 33% Agree 40% Neutral 17% Disagree 7% and Strongly Disagree 3%

Lack of proper advice and guidance in marketing the product		
	Frequency	Percentage
Strongly Disagree	3	10
Disagree	2	7
Neutral	9	30
Agree	9	30
Strongly Agree	7	23
Total	30	100

From the above table it is interpreted that they strongly agree with problems they faced by running the enterprise by lack of proper advice and guidance in marketing the product is 23% Agree 30% Neutral 30% Disagree 7% and Strongly Disagree 10%

Gender bias and non-acceptance		
	Frequency	Percentage
Strongly Disagree	1	3
Disagree	2	7
Neutral	5	17
Agree	10	33
Strongly Agree	12	40
Total	30	100

From the above table it is interpreted that they strongly agree with problems they faced by running the enterprise by Gender bias and non-acceptance is 40% Agree 33% Neutral 17% Disagree 7% and Strongly Disagree 3%

Balancing of business and personal life		
	Frequency	Percentage
Strongly Disagree	2	7
Disagree	3	10
Neutral	5	17
Agree	8	26
Strongly Agree	12	40
Total	30	100

From the above table it is interpreted that they strongly agree with problems they faced by running the enterprise by Balancing of business and personal life is 40% Agree 26% Neutral 17% Disagree 10% and Strongly Disagree 7%

Findings :
1. It is found that 33% of the respondents are below 30 years and 30 % of the respondents are between 31-40 years and 41-50 years and only 7% of the respondents are between 51-60 years.
2. It is found that 73% of the women entrepreneurs are the married women and 10% are unmarried and 10 % are widow.

3. It is found that 40% of the respondents are illiterate 27% are below ssc, 16% are SSC 7% are inter/diploma holders and 10% Degree holders.
4. It is found that 74% of the respondents belong to Hindu 16% Muslims and 10% Christians
5. It is found that 77% are Nuclear family and 23% are Joint Family
6. It is found that 40% of the respondents respond that they have joined the SHG by self 27% by neighbors 23% by family members and 10% by group members.
7. It is found that majority of the respondents joined SHG's for the economic development and self employment. Only 10% of the respondents joined for meeting home needs and 16% for all the above.
8. It is found that therespondents strongly agree with motivational factor to overcome unemployment problem is 40%   Agree 27% Neutral 16% Disagree 13% and Strongly Disagree 4%
9. It is found that the respondents strongly agree with motivational factor to gain social status is 47% Agree 33% Neutral 16% Disagree 4% and Strongly Disagree 0%
10. It is found that the respondents strongly agree with motivational factor to lead independent life is 27%   Agree 33% Neutral 23% Disagree 7% and Strongly Disagree 10%
11. It is found that the respondents strongly agree with motivational factor to family from economic crisis is 40%   Agree 27% Neutral 16% Disagree 10% and Strongly Disagree 7%
12. It is found that the respondents strongly agree with motivational factor to utilization of government schemes and assistance is 40%   Agree 40% Neutral 17% Disagree 3% and Strongly Disagree 0%.
13. It is found that therespondents strongly agree with motivational factor for employment generation to others is 34%   Agree 40% Neutral 20% Disagree 3% and Strongly Disagree 3%
14. It is found that the respondents strongly agree with problems they faced by running the enterprise by lack of entrepreneurial skills is 30%   Agree 26% Neutral 34% Disagree 7% and Strongly Disagree 3%
15. It is found that therespondents strongly agree with problems they faced by running the enterprise by competition in the market is 33%   Agree 40% Neutral 17% Disagree 7% and Strongly Disagree 3%
16. It is found that therespondents strongly agree with problems they faced by running the enterprise by lack of proper advice and guidance in marketing the product is 23%   Agree 30% Neutral 30% Disagree 7% and Strongly Disagree 10%
17. It is found that the respondents strongly agree with problems they faced by running the enterprise by Gender bias and non-acceptance is 40% Agree 33% Neutral 17% Disagree 7% and Strongly Disagree 3%
18. It is found that the respondents strongly agree with problems they faced by running the enterprise by Balancing of business and personal life is 40%   Agree 26% Neutral 17% Disagree 10% and Strongly Disagree 7%.

Recommendations:

1. It is to suggest that the government has to provide training programs for the rural women entrepreneurs for improving entrepreneur skills and how to market the product.
2. It is suggested to provide space for the rural entrepreneurs in the trade fares conducted by the MSMEs to market their products.
3. It is suggested to increase the awareness programs in the rural area that the family members of the rural women entrepreneurs to support them in balancing their work and personal life smoothly.

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SOLUTION OF LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS BY USING VEDIC MATHEMATICS

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ABSTRACT

The system of Vedic Mathematics brings out the coherence naturally inherent in Mathematics and all topics in it. This paper shows the solution of linear and non linear Differential Equations by using Vedic Mathematics .For this we use the Vedic Sub sutra "By alternate elimination and retentation" and also we will do it by successive "Duplexes". we also use the Techniques of Vedic Mathematics to solve the differential Equations.

KEYWORDS   Linear and non-linear Differential equations, Elimination, Retentation, Duplexes

INTRODUCTION

In Vedic Mathematics there are sixteen sutras and thirteen subsutras .The subsutra lopansthanabhyam means alternate elimination and retentation gives the solution of differential equations. Modern Mathematics contains many approaches like Cartesian product , functions of several variables , maximal and minimal elements, integration and differentiation etc.In other words "mathematics is the queen of all sciences" .Using Vedic mathematics in this approaches,we make easy Mathematics.This paper proposes two distinct ways , in which we solve in first way the solution of linear and non –linear differential equation in recent trends and in other ways we solve it by Vedic Mathematics which makes it enjoyable and personally relevant.

WHAT IS DIFFERENTIAL EQUATION

A Differential equation is a Mathematical equation that relates some function with its derivatives represent their rates of change and the function represent physical quantities and the equations defines a relationship between the two. Differential equation play an important role in many disciplines like Physics, Economics and Engineering. In this paper we solve the linear and non-linear differential equations in two manners one is modern method and second is by vedic Mathematics.

SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS BY MODERN METHOD

EXAMPLE

$\frac{3dy}{dx} + 2y = 18 + 8x$ y'(0)=4

i.e $\frac{dy}{dx} + \frac{2}{3}y = 6 + \frac{8}{3}x$

Integrating factor $e\int \frac{2}{3} dx = e^{\frac{2}{3}x}$

Solution

I.F y=$\int$ I.f.Q.dx

$e^{\frac{2}{3}x}$ y $= \int e^{\frac{2}{3}x}$ (6+$\frac{8}{3}x$) dx

$\qquad = \frac{e^{\frac{2}{3}x}}{\frac{2}{3}}\left(6 + \frac{8}{3}x\right) - \int \frac{3}{2} e^{\frac{2}{3}x} \cdot \frac{8}{3}$ dx

$\qquad = \quad \frac{3}{2} e^{\frac{2}{3}x}\left(6 + \frac{8}{3}x\right) - \frac{4e^{\frac{2}{3}x}}{\frac{2}{3}} + C$

$\qquad\qquad\qquad\qquad = \quad e^{\frac{2}{3}x}[9 + 4x - 6] + C$

Y $\quad = \quad 4x + 3 + C\ e^{-\frac{2}{3}x}$ ---------(1)

$\frac{dy}{dx} = 4 + \ -\frac{2}{3} e^{-\frac{2}{3}x} C$ ……………………(2)

Now using condition   y'(0)=4 in equation no.(2) gives

$$4 = 4 + C$$

i.e. c=0

now using c= 0 in eq^n (1)   , we have

$$y = 4x + 3$$

SOLUTION OF LINEAR DIFFERENTIAL EQUATION BY VEDIC MATHEMATICS

Now by Vedic mathematics we solve linear differential eqution by using subsutra "By Alternate Elimination and retention"

2 $\quad y = \ a + bx + cx^2 + dx^3 + - - - - - - - -$ Row I

3 $\quad y' = \ b + 2cx + 3dx^2 + - - - - - - - - - -$Row II

$\quad 18 + 8x \qquad\qquad\qquad\qquad$ Row III

To facilitate the working, the right hand term of equation have been placed in a third row . Thus for each successive yields the next of the unknown a,b,c,d,………thus for each successive column we have

$$using\ 2 * Row\ I + 3 * Row\ II = Row\ III$$

$$2a + 3b = 18 - - - -(1)$$

$$2b + 6c = 18 - - - -(2)$$

$$now\ use\ y'(0) = 4$$

The subsuta here is used "By alternate elimination and retentation"

Then from Row II we have $b = 4$

Now from eqn. I we have

$$2a + 3X4 = 18$$
$$2a = 18 - 12 = 6$$
$$a = 3$$

Now from eqn (II)

$$2b + 6c = 8$$
$$2 * 4 + 6c = 8$$
$$8 + 6c = 8$$
$$6c = 0$$
$$c = 0$$

Similarlary next coefficient will be zero from Row I

$y = 3 + 4x$ exactly

SOLUTION OF NON LINEAR DIFFERENTIAL EQUATIONS BY MODERN METHOD

Non-differential eqn. is of type $\frac{dy}{dx} + py = y^n Q$

General solution

Divided by y^n, we have

$\frac{1}{y^n}\frac{dy}{dx} + \frac{py}{y^n} = Q$

$\frac{1}{y^n}\frac{dy}{dx} + py^{1-n} = Q$ …………………………(1)

Put $y^{1-n} = V$

(1-n) $y^{1-n}\frac{dy}{dx} = \frac{dv}{dx}$

$y^{-n}\frac{dy}{dx} = \frac{1}{1-n}\frac{dv}{dx}$

Put in Eq. (1)

$\frac{1}{1-n}\frac{dv}{dx} + PV = Q$

$\frac{dv}{dx} + (1-n) PV = (1-n)Q$

Now it is type of linear equation and solve it by same method which use in linear differential equation

SOLUTION OF NON-DIFFERENTIAL EQUATIONS BY VEDIC MATHEMATICS

To solve non-Differential equation by vedic mathematics we use "Duplexes Method" which describe as below

DUPLEXES METHOD

For one- digit number Duplexes is its square

For a two- digit number Duplexes is twice their product

For three-digit number Duplexes is twice the product of the outer pair +the square of the middle digit

For a four-digit number Duplexes is twice the product of the outer pair + twice the productof the inner pair

Example

$Y'' + y^2 = 1 + 2x^2 + x^4$

Where $y(0) = 0$ and $y^1(0) = 0$

Column   1   ii   iii   iv   v   vi   vii

$Y \quad = \quad a \ + \ bx \ + \ cx^2 \ + \ dx^3 \ + ex^4 \ + fx^5 + \ gx^6 + \ldots\ldots$

$Y'' \quad = \quad 2c \ + \ 6dx \ + 12ex^2 + 20fx^3 + 30gx^4 + \ldots\ldots\ldots\ldots$

          1   0   2   0   4 ……………………………

Using boundary condition $y(0) = 0$ gives $a = 0$

y' (0)=0   gives b=0   Now using duplexes

For c : from column 1 $2c + a^2 = 1$

Using a =0   , 2c = 1   gives C=1/2

For d : from column II We have

6d+2ba=0   Using a=b=0   ,We have d =0

For e : from column III $12e + 2ac + b^2 = 2$

Using a=b=0   we have   12e=2   gives e =1/6

For f : from column IV   20f +2ad+2bc=0

Using a=b=0   gives f =0

For g : from column v $30g + 2ae + 2bd + c^2 = 4$

Using a=b=0 , c=1/2   We have   30g+1/4 = 4

30g =4-1/4 = 15/4

$$g = 15/4*30 = 1/8$$

$$y = \frac{1}{2} x^2 + \frac{1}{6} x^4 + \frac{1}{8} x^6 + \ldots\ldots\ldots\ldots$$

CONCLUSION

From the above solution we see that the solution of linear differential equation and non-linear differential equation are found very quickly and very simple method. We solve these equations from recent trends and vedic mathematics ,but vedic method is very simple ,time saving and fast result.Here the sub sutra "By alternate elimination and retention" is used to solve the differential equation of both type .Therule can be easily applied to the system of linear and non-linear differential equations. This technique is very useful for higher education.

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LEARNING CONTINUUM: AN APPROACH FOR SUSTAINABLE DEVELOPMENT

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Abstract

In an environment of increased competition, mergers and acquisitions, rapid technological advances and significant societal changes, organisations have threat of being perished. Therefore, it is essential for organisations to transform to a stage where new innovations are achieved through knowledge acquisition and continual learning. The purpose of this paper is to give theoretical understanding of epistemological shift based on qualitative analysis of theory proposed by Argyris and Schon on *Action Research*, Ravens approach on *Action Learning* and Senge's conception of *Learning Organisation*. The paper highlights transition from individual learning (through cognition) to organisational level learning by explicating similarities and distinction based on strategies, structure and roles of action research, action learning and learning organisation. Paper further highlights the impact of such transformation on organisation. Apart from emphasizing the key aspects of learning in organisation the article also highlights the challenges in building and sustaining learning environment. It further intricate critical re-examination of Senge's theory of learning organization by highlighting idea of blending learning theories and actions. At the end, the paper deals with scanning certain traits that can help in assessing whether organisation is truly an authentic learning centric organisation and concludes by suggesting strategies that may encourage in creating learning ecosystem.

Key words: Learning Organisation, Action Research, Action Learning, Learning Ecosystem, System thinking, Learning theories

Introduction

In the environment of continual mergers, rapid technological advances, massive societal changes and competitions, organisations have threat of being perished. Thus, organisations require transforming into learning organisation (LO) where new innovations can be achieved through knowledge acquisition and continual learning to demystify sustainable development.

The purpose of this paper is to give theoretical understanding of epistemological shift based on qualitative analysis of theory proposed by Argyris and Schon (1978) on *Action Research (AR)*, Ravens (1982) approach on Action Learning (AL) and Senge's (1990) conception of Learning Organisation. In all the cases, assertion is learning centred. The article highlights transition from individual learning (through cognition) to organisational learning by explicating similarities and distinctions based on strategies, structure and roles of AR, AL and learning organisation along with their implications on organisation. It emphasizes on the key aspects of learning in organisations beside challenges in building and sustaining learning environment. It further intricates critical re-examination of Senge's theory of learning organization by highlighting idea of blending learning theories and actions. Authors suggest creating a learning ecosystem for developing and nurturing learning in organisation.

The paper deals with scanning certain traits that can help in assessing whether organisation is truly an authentic learning centric organisation and concludes by suggesting strategies that may encourage in creating learning ecosystem.

System thinking for overall organisational development

System thinking can be the best exercised when dealing with all the three levels that is individual, group and organisation. In reposition to today's global environment, organisations often demand vibrant prominence of continuous learning and development. Various authors emphasis on systemic thinking as steady contemporary approach for overall organisational development (Bell, 2008; Burns, 2007; Coghlan and Brannick, 2014; Jackson, 2003; McIntyre, 2008; Reason and Bradbury, 2006; Gold, 1999; Burnes, 2004; Caldwell, 2012; Schon, 1996; Styhre, 1978, Styhre, and Sundgren, 2005, Elkjaer, 2004).

At individual level, organisational members need to be learners and responsive. As learning is cognitive process it must be shared episodically in a group, so that members may learn and engage in open discussion for holistic thinking. At organisational level it may be composed of key related tasks as 'system thinking' which plays a major role in dealing with uncertainties and complexities of business practices and considered as important for organisational survival and growth. For developing a well-designed system, collaboration and coordination is required among different structures and departments of organizations.

Organizational learning: Theory and conceptualization

Senge's learning organisation can be congregate as an inclusion of system thinking and learning theories as the theory is based on Lewin's OD Model of AR and Revan's preposition on AL. AR accentuates on improving practical affairs by emphasizing on actions as a self-reflective enquiry undertaken by participants in order to improve the rationality and justice of their own practice. Senge's idea was conceived through Lewin's OD models of 'action research' and group learning (Schon,1996; Caldwell,2012). Here AR is used as a model for practice-based inquiry and the idea is conceived through knowledge and learning as cognitive and instrumental part of actions that are discernible and recognised rationally (Lewin, 1999; Burnes, 2004; Caldwell 2011). Although Lewin has straight one-dimensional focus on individual cognition as a part of human personality it may be extended to small group learning processes. In this case learning is being treasured as a cognitive form of behavioural change perhaps proceeded by determining cognition

at a higher level. AL and AR have some fundamental differences (McGill and Beaty, 1995; Raelin, 1999), both share the same values based on learning, having similar learning cycle that focus on learning in action. They also emphasise collaborative interactions both constructs individual learning and group exploration as a part of their approach. Fundamental difference in AR and AL lies in the action learning process that envisages participant's learning through action. These learning essentials takes place through the learning set which provides an opportunity to exchange ideas on existing models or experiences or new theories (Ritze´n et al. 2005); while AR may be undertaken through working with others. In AR the methodology not only emphasizes on generation of actionable knowledge but is parallel research by creating ''first person'' and ''second person'' inquiry/practice (Reason and Torbert, 2001) where the second-person inquiry supports and enhances first-person's inquiry. AL and AR combine several approaches where the common purpose is to inspire participants to implement new ways of working through trustful and collaborative way, to increase innovative capability among individuals as well as organisation as a whole (Ritzen, 2005).

Single and double-loop learning

Lewin's and Revan's enduring work is the expression of modernist view point which has been reconstructed constantly in OD's tradition. Crucial epistemological shift traced in Argyris's and Schon's (1978) study draws a peculiarity in single and double-loop learning. Single-loop learning is reactive, based on rational model for corrective action or 'theory-in use' as a predictive situation which may be guided by scripted rules and procedures. In contrast, double-loop learning is the process of learning to change where self-reflective and dogmatic values breaks the cycle of single-loop learning by recognising errors that not only improves action but also the values that govern the theory (Argyris, 2004). Making explicit rules, strategies, structures and roles are the foundations of organizational learning. The transition from individual cognition to organizational-level learning and change is partly possible because of double-loop learning. Argyris and Schon (1978), extend individual cognitive process as a credible source for executing actions at organizations level. Senge emerged as a moderate rationalist by depicting his conventional ideals of OD through expert knowledge. Senge (1994) identifies knowledge and learning as a course for generating consensus at top-down systems where learning is vital for whole system.

Action Learning

Revans is considered as one of the most significant contributor in AL practice. Other than Revans, authors like Fenwick, 2005; Marquardt, 2004; Vince, 2003, 2004, Dilworth and Willis 2003, Yonjoo and Egan, 2009 have contributed in describing AL. It is identified as "A process of reflecting individual's beliefs and action so as to gain new insights and resolve real problems". AL is often considered as an organization change strategy and recurrently directed towards individual learning and development (De Loo and Verstegen, 2001, 2002, 2006; Peddler, Burgoyne, & Brook, 2005; Vince, 2003, 2004). The term action in AL signifies the "pathway or "basis" where the task being the channel for learning (Raelin, 1999, 2008). Pedler (2005),further elaborates that the problem or addressing real issue is critical as it is linked with learning from the experience (Rooke et. al 2007).

Organisational implications of Action learning

In a changing environment organizations must possess the ability of learning and transferring knowledge (Olsson et al., 2010).Organisations need to create innovative capability among individuals which stimulates, revive and reconstructs resources for organisational development. These include work procedures, organisational and technical learning. For doing this organizations need adaptation of AL practice that can identify learning and re-use of knowledge as a crucial factors for creating environment for learning.

The major challenge faced by organisations while implementing AL is to ensuring balance between action and learning while working on a real life problem (Kim, 2007; Kuhn &Marsick, 2005; Pedler, 2002). Developing a balance perhaps can be achieved through evaluating AL processes where action is learning output as well as an input to the process. This can be measured through participant interaction, experiences and the manner in which learning outcomes are framed. It can also be diagnosed through altered work climate, development at overall organization level (O'Neil &Marsick, 2007; Rooke et al., 2007). Thus AL may be considered as a powerful approach for HRD and management development (Dilworth & Willis, 2003; Marquardt et al., 2009; Reynolds & Vince, 2004;O'Neil, 2007;Willmott, 1994).

Action Research

Action Research as an emerging inquiry process collaborates for the purpose of addressing organisational issues so as to generate new knowledge for on-going organisational renewal. Coghlan and Brannick, (2014) and Coghlan and Shani, (2005) elaborate AR as approach emphasising upon taking actions and creating knowledge or theory about that action. The outcomes are both an action as well as research oriented. AR is a cyclical process and consists of stages such as (a) planning (b) taking action (c) evaluating the action, leading to further planning and so on (Coghlan and Brannick, 2014). The methodology may not be classified into one single approach; rather it includes levels of inquiry, approaches and activities. Thus AR is viewed as a holistic process that comprises several sequential dimensions through various strategies and policies (Reason and Bradbury, 2005). From a design perspective, AR conceives both theoretical insights and practical effects (Bab¨uroglo and Ravn, 1992).

Organisational implications of Action research

Implementing AR within the organisation requires working in respect to system relationship and its dependence pertaining to different levels within organisation. In organisation there are various levels such as individual, group and team and their relationship based on system dynamics, recursive system model. These levels highlight the relationship with each other at iterative stage from individual to group/team and its impact on organisation as well as on stake holders. The analysis takes place through feedback, loops and sequences of interactions. Researches provide integration at three levels. First individual's own level of learning and actions that takes place in the form of first-person inquiry in AR (Fisher.et. al, 2000;Relin, 2000; Coghlan and Brannick, 2014; Kolb, 1984; Coghlan, 2002) as individual action and change may have an impact on change at larger and complex level. The second level of change is required through Second-person's inquiries which disseminate the work at wider level among groups and teams. Further, research and change process need to extend through whole organisation and its external

environment to promote organisational change and development and thus pertaining the process planned change and organisational learning (Katz and Kahn, 1978;Coghlan, 2002). The application of inter level dynamics through first and second person research is significant for understanding and enacting cycles of AR.

Learning Organisation

Senge's idea of learning envisages on the idea of "learning through expert rather than learning through actions" thus developing learning organisation as a corollary of learning.

Organisational implications

Senge highlights five components of learning organisations: systems thinking, personal mastery, mental models, shared vision and team learning. These components strengthen together so as to develop connection and interdependence of actions. System thinking is regarded as an essence and fosters other four disciplines. As system thinking endures through conceptions, feedback, pre conceived notions and pre-determined archetypes, as a model to represent knowledge and change. Second principle is represented as 'managing mental models' which is referred as cognitive model for learning. The third principle emphasizes on 'building a shared vision' by creating a common sense of function through consultation and discussion in a collaborative way. The fourth principle is 'team learning' which emphasizes on creating shared learning and knowledge within and outside group while fifth discipline is 'personal mastery', which means people should have mastery over themselves and be strongly committed towards learning. It is important to take into consideration to all five aspects (Chandrasekhar, 2011) so as to nurture system learning that may avoid uncertainties and complexities of business practices. Further, organisations must strive to get these five principles right so as to face new challenges, trends and issues easily and respond to the change.

Insights from learning theories for developing learning environment

The term "blended learning theories" may be used in order to provide a suitable learning solution through mix of actions, experience, reflections as blended learning. The blended learning offers more choices to learners and richer sets of learning strategies. These learning sets develop through systemic nature of interlevel dynamics pertained in ARand AL. AR is integrated process and develops sustainability by ensuring learning through experiences and sharing knowledge within or outside organisation or with expert persons in the area for professional or academic field (Coghlan, 2002). Senge proposed a principle based on 'learning through expert'. These ideas are based on constant strive to improve and succeed through predicting clear picture of future knowledge requirement along with creating a platform that fosters knowledge management. As learning organisations basically work on issues and problems it is crucial to share useful lessons among individuals involve in the practice and not just work as knowledge repositories. Organisations must incubate environment that values learning, achievements and actions. Learning organisationsconvolute throughtotal employee involvement and collectively accountable change directed towards shared values and principles (Watkins and Marsick, 1992).Summing up, we can say that organisation may be recognised as learned only when sharing experiences provides an opportunity to learn and develop.

Developing Learning Eco-System: Managerial implications

Learning as action may seem self-evident, but it raises issues about 'rational' or 'effectiveness 'of learning and 'self-deception' (Argyris, 2004). Today, organisations are required to be reflective and try to learn and adopt change. For doing so, organisations are required to create a distinctive value preposition which may be crucial for organisation survival and growth. As learning is an activity that may be inculcated through corporal and social practice, Senge proposed a principle based on "learning through expert". However, rather than acquiring expert knowledge one should acquire learning through experience. For this, organisations must try to generate interest among participants for learning through creating a learning environment that may develop understanding about business dynamics. Organisation must emphasize on analysing a gap between existing and required skills and try to bridge those gaps through appropriate learning interventions. For this, organisation must develop and nurture system learning through self-directed learning and must be aligned with need of organisation that ought to integrate rationality, expertise, autonomy, culture, structure and roles reflexivity in the system (Caldwell, 2012).Thus, organisations need to create an ecosystem that enables learning culture among every member of organisation. For creating learning ecosystem, organizations should emphasise upon connecting innovations with learning. Learningshould not be static, instead it should be a dynamic urge for being learner and continue over life time.

There are some identifiable common features for developing learning ecosystem Organisations must have clear picture of future organisation requirements

- Organisations mustemphasize on creating platform for knowledge sharing and knowledge management.

- Organisations must be aware of and interact with their environment.

- Organisations must develop goals, achieve result and quality of work in world class manner, anduse the result of learning for the betterment of organisation.

Organisation must adopt 360 degree learning which is a holistic intervention that includes, experiments, workshops, followed by action projects in order to map employee learning needs to their specific roles. 360 degree approach ranges from developing functional competencies to generate skills and managing structure, culture, technology, identity, memory, goals, incentives and strategies for meeting learning need of current and future. Organisations must be able to identify and analyse learning interventions at different levels. Thiswill become more significant when all the stakeholders are aliened and must value their learning prepositions in order to meet lifelong learning. As technologies are changing rapidly, organisations are using blends of learning approaches in their strategies which may combine real-time /virtual, web based leaning, video based, self –paced learning etc. Now days learners are engaged with interactive models and rich media including social media, community blogs, Wiki's and mobile performance tools. This can act as best alternatives for dealing with Gen-Y employees. Mentoring and coaching may be considered as a support system for learning as they help in career planning and development and grooming employees for future roles.

Conclusion

Organisations have capability to transform themselves into intelligent systems for change. If organisations learn faster they will adopt and grow faster. Senge's preposition of learning emphasizes on "learning through expert rather than learning through actions". However, as learning is not complete without actions,organisations should emphasize on generating learning experience also. This will assist them in moving towards learning effectiveness by focusing on learning outcomes, their methodologies and performance. As a result, individual will learn new skills or ideas and their productivity at work may increase as individual gains expertise. The article suggests communicating their credentials and performance so as to shift organisation focus from work force to proficient practitioner.

In practice organizations can create a learning eco system through highlighting identifiable common features of formalising informal learning for Gen–Y through real-time/virtual, Web based leaning, video based, self –paced learning, social media, community blogs, Wiki's and mobile performance tools, learning management system (LMS).It further suggests adopting 360 degree learning as a holistic approach including learning at different level that may foster in developing learning ecosystem. Thus learning can be said to be most essential component for organizations survival.

Figure 1: Blending learning theories and approaches for developing learning ecosystem

Web based leaning

Video based learning

Sharing own experiences

Action Research

Identify own actions

Improve owns practice

Action Learning

Drawing insight and learning from own experiences

Directed towards own development through learning experiences

Learning organisation

Achieve sustainable development through knowledge acquisition and continual learning

Directed towards individual and organization change and development

Self –paced learning

Mentoring

Coaching

Social media

Blended learning approaches and learning solutions for developing "Learning Ecosystem".

Mobile performance tools

Community blogs

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A study on satisfaction of pilgrims from services offered by Shri Gajanan Maharaj Sansthan Shegaon

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Abstract: *The present study is designed to make an attempt at the micro level to understand and critically examine the satisfaction received by pilgrims from the services provided by SGMSS. The scope of study covers the History, Organisation, financial and administrative aspects of the SGMSS. The scope of the study is limited to the study of SGMSS. The efforts are made to know about the services provided by SGMSS & various activities under taken by it. It is found from the research that pilgrims are satisfied with the services offered by SGMSS.*

Keywords: Gajanan Maharaj Temple, Satisfaction, Services

1.1 Introduction: India is a sacred land of holy temples rich in architectural and sculptural beauties. The temples have an important place in the socio-economic development of the people and contribute to the idea of national integration. They play a prominent role in preserving and propagating Indian Arts and culture. There are other religious organizations like in the country. They all provide spiritual welfare to the people who belonged to the respective religious systems. These organizations afford opportunities to the people for country. The socio-cultural aspects vary widely from one region to the other. Religion is one of the social institutions in the country and it the product of human ingenuity with the purpose of enabling man to be at peace with himself and with the supposed agency that would guide and control the universe. The religion would differ from place to place and has undergone numerous developments from time to time yet retaining substantially in some form or the other of its basic principles and practices.

There has always been a section of people who asserted that the Government should not interfere in the matter of religion and charity. There are others who hold the opposite view, perhaps on equally strong base to the Government interference and control into the conduct of religious institutions, if the religious institutions seem to be drifting away from their prime goals or when things go wrong with them. But whatever may be the justification, unqualified and unrestricted Government control in matters concerning religion could be undesirable and unwarranted. Therefore, it was felt desirable to go into all aspects of this issue and make possible suggestions. The operations of the SGMSS are not only confined to the propagation of Hindu religion, but also enter into the national life by extending its helping hand for social upliftment of the people in the country. Apart from the worships provided in the temples for pilgrims, the SGMSS is providing extensive facilities and amenities to visiting pilgrims for their comfortable stay when they come for darshan of the Shreene of Shree Gajanan Maharaj. So far, no attempts was made for a comprehensive study of the utilization of finances for social service of religious institutions

in Maharashtra and with special reference to the SGMSS, which is considered to be most transparent religious institute in Maharashtra. In recent years, by launching various schemes and programmes, the activities of the SGMSS have spread over to different parts of the country. It was felt desirable to go into all aspects of social services and expenditure pattern of the SGMSS to have a close look on its effective functioning. There had been a lot of dissatisfaction among the public over the working of different religious institutions in the State and on their utilization of funds. The present study seeks to understand and examine the distinctive features of financial and social service aspects of the SGMSS. Due to growing importance of SGMSS in diverse fields, a study on the social services and finances of the SGMSS is now perhaps most appropriate.

1.2 Review of literature: In order to understand the concept of management of temples in Maharashtra, a survey of relevant literature was conducted. Books written by authors were helpful in identifying the evolution of Hindu temple worship and its administration. A few books by historians and ethnographers helped in identifying the sources of data for the study. The available literature is related the development of temples worship and its administration and management.

Dr. Ramaswami Aiyar (1963) presents a brief, yet vivid account of Indian heritage and culture. The book also describes the contributions made by various dynasties to the varieties of social, cultural and religious of India. The author has identified various religious institutions functioning in India. The book provides information on how the practices of worship in temples got institutionalized during the periods of different monarchs. The author has examined the role of priests in the development of temple worship. The book gives an overview of the growth of temple worship in India. Since the entire work is centred on Central and North Indian, it becomes necessary to examine the practices prevailing in Kerala.

Dale Glasser, (2005) in his book Building and Maintenance Supervision include general questions about the temple facilities and arise some question about temple management like (1) who may use the facilities and for what purpose? (2) Who will be responsible for their maintenance? (3) How will the operating cost of Manpower, Utilities in Management system? Etc. Chapter also focus on the role of building superintendent, the role of temple building committee, the role of the temple administrator.

1.3. Objectives of the study:

1. To study the satisfaction of pilgrims from the services offered by SGMSS

2. To evaluation the overall satisfaction of pilgrims from the various services offered by SGMSS.

1.4. Hypothesis of the study:

H01. That religious trust (SGMSS) provides satisfactory services & management.

1.5 Research Design:

Descriptive Research: In the present research, an attempt is made to describe various social services provided by Shree Gajanan Maharaj Sansthan, Shegaon.

In the present study all the pilgrims who have visited Shree Gajanan Maharaj Temple for darshan are considered as universe of the study and out of them 500 pilgrims who visited the temple during the period 2013-14.

In the study, both types of sampling techniques, Simple Random Sampling as well as Judgmental/Purposive Sampling is used to investigate the research problem under consideration. To test the hypothesis "That religious trust (SGMSS) provides satisfactory services & management" one way ANOVA test is applied taking satisfaction from services as fixed factors and quality of various services offered by SGMSS as dependent variables, where following results were obtained:

ANOVA

	F	Sig.
Annadan	137.053	0.00
Medical Aid	213.637	0.00
Education	1101.68	0.00
Help to Handicap	301.861	0.00
Accommodation	360.685	0.00
Transportation	1577.73	0.00
Cleanliness	211.2	0.00
Mukh Darshan	849.09	0.00
Cloak Room/Locker	172.204	0.00
Library and Reading Room	130.879	0.00
Water Supply Scheme	1214.65	0.00
Sevadhari Vibhag	300.606	0.00
Cultural Centre	26.321	0.00
Hot water to devotees during winter	229.966	0.00
Free and Safe Parking Facility	384.52	0.00
Free Shoe Stand	157.995	0.00
Distribution of new clothes and sweets to Adivasi brothers	113.595	0.00
Fire fighting/Fire Brigade Service	641.607	0.00

The above ANOVA table gives the F value and the p-value (sig. value) for the variables representing quality of services offered by SGMSS. It is found from the analysis that, in case of all the variables representing quality of services, p-value obtained in the 6th column of the above table is 0.00 which is less than the alpha value of 0.05 (P<0.05), which states that respondents are satisfied with the services provided by sansthan. Hence, the hypothesis that religious trust (SGMSS) provides satisfactory services & management is **accepted**.

1.6 Findings and Conclusions: Following are the findings: of the research

From the primary data it is found that, Pilgrims visiting from outside did not face any difficulty in getting the accommodation. It is further observed that paid accommodation is hardly adequate during holidays and festive occasions. Regarding the quality of canteen at SGMSS, majority i.e.

57% of the respondents are satisfied with the quality of canteen and also with the quality of food served at canteen. The human resource in the form of 'sevekari' is the strong point in the administration of the SGMSS. It is observed that SGMSS has a strong support from the devotee volunteers.

1.7 Suggestions: It is further suggested that the system of administration should be set up, for this a separate department named 'Statistics Department' should be developed and it should provide management information system. The department may be entrusted with work of compilation and analysis of data in respect of pilgrims, income, expenditure, amenities, investments and other schemes, etc. This will be of immense use to the administration in taking various decisions.

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Corporate Social Responsibility (CSR) and its impact on the performance of Indian banking sector(A case study of ICICI Bank of India)

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Abstract

In the present scenario corporate social responsibility (CSR) is getting greater importance in the corporate world including banking industry. Corporate social responsibility is emerging as a significant feature of business ideology which shows the impact of business on society in reference to social and economical development. In developing country like India the banking industry plays an important role in providing funds for development and growth of the economy. ICICI Bank is the second largest bank in India in terms of assets and capitalization. It is also awarded with best bank award for business intelligence initiatives among largest bank by Institute for development and Research in banking technology (IDRBT). The objective of this paper is to study the relationship between ICICI Bank's CSR expenditure and its performance and this study will also provide information about the ICICI bank's activities under its Corporate Social Responsibility program. The research methodology involves application of Pearson's correlation to conduct the statistical investigation among different parameters of the study. This study is based on secondary data which is taken from various sources.

Keywords: Corporate Social responsibility, Bank, Assets, Equity

Introduction

Corporate Social Responsibility is now an integral part of most businesses. Corporate social responsibility is a technique through which the corporate organization has executed their benevolent vision of social welfare. In the past few years CSR activities has witness tremendous increase in its performance, awareness and control in the global arena. According to the World Business Council for Sustainable Development in its publication *Making Good Business Sense* by Lord Holme and Richard Watts, states that "Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large". Peter F.Drucker states that, Business should develop concern for society and peruse welfare activities which should form an important area of operation. It is a demand, that quality of life becomes the business of businesses. The new demand for business is to make social values and benefits, create freedom for individuals and all together a good society. The CSR definitions show that it's not new at a conceptual level; business has always had environment, social and economic impacts, been concerned with government, stakeholders, customers or owners, and dealt with regulations. Corporate social responsibility has been managed through established patterns developed over number of years.

The Corporate social responsibility (CSR) in Indian banking sector is aiming towards to achieve financial inclusion by providing banking and other allied services to the economically backward areas of the nation. In this, ICICI Bank is pro-actively supporting meaningful socio-economic development in India and enables a larger number of people to participate in and benefit from India's economic progress. The CSR policy of ICICI bank is based on the ideology that growth and development are effective only when they result in wider access to opportunities and benefit a broader section of society. The aim is to   find crucial areas of development that needs investments and intervention, and which can help to realize India's potential for growth and prosperity.

Literature Review

While there are many research papers which have examined the relationship between CSR and banking performance and the outcome of these studies are different from each other because CSR can vary from industries to industries and also according to social needs of time and society (Amran etal,2013). All the organizations have different type of responsibility such as: Economic, Social, legal and etc. Many researchers have studied CSR with different prospective and they are as follows:

World Business council for Sustainable Development (2001), Mention that Corporate social responsibility (CSR) can support the management by making it more committed toward business and towards the sustainable development of the society.

Waddock and Smith(2000), stated that, Corporate Social Responsibility (CSR) and orientation of banks can be a useful tool for them to tide over crises in future, it also helps the bank in maintaining the relations with their stakeholders.CSR among other things is a key stakeholder relationship building activity.

Marsden, (2001) explained Corporate social responsibility (CSR) as the core behavior of organizations and the responsibility for their total impact on the societies in which they work. CSR is not an optional add-on nor is it an act of philanthropy. A socially responsible corporation is one that runs a profitable business that takes into account of all the positive and negative social and economic effects which has its impact on society and economy.

Objective

- To study the activities of ICICI bank undertaken under Corporate social responsibility of last three years.
- To study the relationship between corporate social responsibility (CSR) expenditure ICICI bank performance.

Research Methodology

The research methodology of this paper comprises the data collection, data analysis and interpretation. Data is taken from secondary source, most of the data is extracted from the annual reports of the ICICI ban

Assumption:

- As per the standard government regulation the 2% of average Net Profit of the bank for past three years should go for CSR expenditure and therefore it has been assumed that ICICI bank must have allocated around 2% of average Net profit towards the Corporate social responsibility (CSR) expenditure for fulfilling the set regulation.
- The firm's performance is measured only by two variables and they are: Return on Equity(ROE) and Return on Assets (ROA).

Variables

- This research paper includes three variables, these variables are: independent variable, dependent variable and control variable.
- The variables which are representing performance of the bank is taken as dependent variable, these variables are: return on assets (ROA) and return on equity(ROE).
- The Corporate social responsibility expenditure of the bank is treated as independent variable as it is extracted from the average net profit of the bank.
- The control variables include board meeting, board size and all other factors which can affect the CSR and ICICI bank performance.
- . The expenditure on corporate social responsibility of ICICI Bank comprise of expenditure made by the bank on education, rural development, welfare of armed forces, women empowerment, health etc.
- Return on Assets shows profit of an organization in relation to its total assets; here, data of return on assets of ICICI Bank is taken from the period 2015 to. 2018
- Return on equity measures profitability of an organization in relation to shareholders equity. Data of return on equity of ICICI bank is taken from the period 2015to2018.
- Net profit of ICICI bank is taken from its annual report for the period of 7 years i.e. 2012 to 2018.

Analysis & Interpretation:

<u>Corporate social responsibility (CSR) Expenditure and Activities of ICICI Bank and Manner in which amount is spent</u>

CSR Project or activity identified	Sector in which the project is covered	Cumulative expenditure upto the reporting period (` mn) Year-2018	Cumulative expenditure upto the reporting period (` mn) Year-2017	Cumulative expenditure upto the reporting period (` mn) Year-2016
Projects of ICICI Foundation for Inclusive Growth	Promoting education, awareness, employment, enhancing vocational	1,745.0	1,185.0	710.0

	skills, livelihood enhancement projects			
Rural development and related activities	Rural development	4,678.6	3,637.5	2,334.3
Armed forces welfare	Measures for the benefit of armed forces veteran, war widows and their dependents	50.0	-	-
Financial Literacy	Promoting education	56.2	26.2	-
Miscellaneous	Women empowerment, promoting education, promoting healthcare, awareness campaign, Swachh Bharat, environment protection	71.3	48.1	-
Contribution towards relief and welfare in calamity affected areas	Contribution to Prime Minister's/ Chief Minister's Relief Fund	-	-	76.5
Gift a Livelihood programme	Livelihood enhancement	-	-	25.7
Supporting research and capacity building in education sector	Promoting education	-	-	59.1

Source: Annual Reports of ICICI bank

The above table shows that ICICI bank is spending the highest amount on the Projects of ICICI Foundation and NGO's followed by rural development and related activities and on welfare

Programs like:

Womenempowerment,promotingeducation,promotinghealthcare,awarenesscampaign,   Swachh Bharat, Relief Fund, environment Protection programs etc.

Relationship between Corporate social responsibility (CSR) Expenditure and bank performance of Axis bank

Corporate social responsibility expenditure is the expenditure on activities related to social and economic development. As per government regulation the quantum of corporate social responsibilityexpenditureshould be 2% of declared average net profit of the bank. In the same way we have determined corporate social responsibility expenditure from the year 2015 to 2018 as given in below mention table. The returns of assets (ROA) and return of equity (ROE), both these measures are determined form the annual reports of ICICI bank from the year 2015 to 2018.

To calculate the relationship between CSR Expenditure and bank performances of ICICI bank correlation coefficient has been calculated using MS Excel worksheet.

Statement of correlation between Return on Equity (ROE) and Corporate social responsibility (CSR) expenditure

	2018	2017	2016	2015
Return on equity(ROE)	6.60%	10.34%	11.34%	14.32%
Avg. Net profit	87,682,669	102,342,443	102,373,730	97,704348.6
CSR(cr)	170.3	182	172	156

Correlation Between ROE and CSR expenditure -0.536759

Interpretation: There is a correlation (i.e. - 0.536) between return on equity (ROE) and CSR expenditure. The negative sign is due to Equity represent inflow of cash whereas CSR represents outflow of cash.

Statement of correlation between Return on Assets (ROA) and Corporate social responsibility (CSR) expenditure

	2018	2017	2016	2015
Return on Assets(ROA)	0.87%	1.35%	1.49%	1.56%
Avg. Net profit	87,682,669	102,342,443	102,373,730	97,704348.6
CSR(in cr)	170.3	182	172	156

There is a correlation between return on assets and corporate social expenditure of ICICI bank. This shows that CSR is not only benefiting the society but also improving the conditions of the business.

Conclusion

From the above study it has been concluded that:

- The CSR initiative has a moderate bearing on ICICI bank performance measured in terms of Return on Assets(ROA) and Return on Equity(ROE)
- There is a moderate correlation between Return on Assets (ROA) Vs.CSR expenditure as well as Return on Equity (ROE) Vs. CSR expenditure.
- Security Exchange Board of India (SEBI), Reserve Bank of India (RBI) and Ministry of Corporate affairs (MCA) issues guideline on regular basis for very businesses to follow all the rules and regulations.
- There is specific guidelines for corporate social responsibility (CSR) bill 2013 which are applicable from 2014-15.
- The complete study is based on secondary data taken from annual report of ICICI Bank starting from 2015 to2018.

Limitations

The study is based on secondary data which is taken from ICICI bank's annual report (Any manipulation and window dressing will leads to misleading analysis).this study is limited to the study of two variables of bank performance only.

Scope for future research

- The study provides a good idea of degree and direction of CSR and bank performance.
- Further researches can do on the association between other parameters with respect to different industries.

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Introspecting the Antecedents of Changing Dynamics in Talent Acquisition and Talent Management

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Abstract
Talent Acquisition and Talent Management are very critical to any organization. Technology has paved way for innovative methodologies in the otherwise traditional approaches in these processes. In order to understand the modern dynamics of these processes an in depth analysis needs to be conducted and identify the prevailing antecedents for the same. The paper attempts to study the traditional and the modern disruptive talent acquisition process, identify the influence of modern factors on changing dynamics of talent acquisition and finally understand the impact of culture, technology, quality of hire and Leadership on Job Retention. SPSS 20 was used for analyzing the impact of these antecedents and develop a proposed model in order to study the individual influence of each of the variables. Leadership, Technology and Culture all were found to be having a non- significant impact towards job retention, whereas Quality of hire was the only factor that significantly impacted job retention. The findings of the study clearly depict that emphasis is more on the quality of the employees hired as compared to other antecedents. Hence it is important for the organizations to have strategies in place for attracting and managing a quality employee for achieving the goal of job retention.

INTRODUCTION:
Talent acquisition helps in shaping the perception of employers in the market and is very dynamic in nature. The process is extremely critical as talent acquisition strategies are important especially for those companies who fail to find right skilled employees. On the other hand talent management comprises of utilizing the strategic human resource leading to enhancing the business value and helping the organizations their business goals. Innovative and dynamic organizational are using the innovative methodologies to harness the best available talent pools.Globalisation has further emerged as a major challenge in redefining the hiring landscape. As per the annual Global CEO survey study done by PWC in the year 2014, the study suggests that companies are preparing hard to implement innovative strategies in their firms (PwC, 2014). UK Department of Business Innovation and publication has argued that governments all over the world are in the favor of sponsoring and promoting innovative designs catering to modern technology. Governments all over world are also in support of promoting and sponsoring innovating design and ideas. The advent of big data gives rise to complex data sets and the

results have shown that new generation millennial are not interested in the traditional definition of professional careers, work, peer to peer collaborative communities. The increasing attrition rates also has been a major challenge with most of the organisations. As stated by Huselid (1995)human resource plays a significant role in augmenting the performance of an organization and effectiveness. Hence it becomes even more important for the organizations to consistently evolve towards attracting the best available talents in the market. In order to leverage competitive advantage and performance management talent plays a major role as differentiator (Bhatnagar, 2004).

Organisations having good strategy of talent acquisition and management can definitely boast of better employee engagement and enhanced productivity.
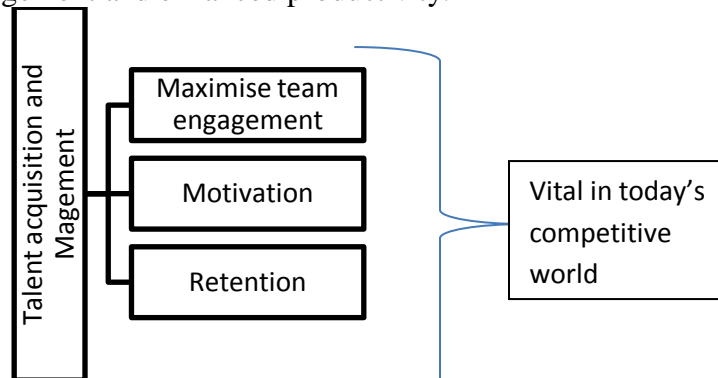
Fig.1 Talent Acquisition and management (Ronn, 2007)

A good talent acquisition and management process that is rightly defined and stated from end to end process will be well executed. It will also result in consistency in the application and will comply with all the prerequisite requirements that will help the organisations achieve the competitive advantage in the talent acquisition and management zone(Ronn, 2007) as shown in fig 1.

Talent acquisition- What it actually is?

- Talent Acquisition Planning and Strategy
- Workforce Segmentation
- Employment branding
- Candidate Audiences
- Candidate Relationship management
- Merits and Analytics

Fig. 2 Strategic Elements of talent Acquisition and Management

The strategic elements of talent acquisition and management are inclusive of various other parameters. From the fig.2 it is evident that talent acquisition and planning is one of the most important strategy that guarantees alignment of business, inspects the various workforce plan in place along with covering for global considerations. Workforce segmentation ensures that there is a thorough understanding of various categories of workforce and their segments. This also segregates the various positions associated with these workforce segments, skillsets required and competencies needed for achieving success. Another important highlight is the employment branding. This helps in uncovering and defining the organizational culture and image of the company. Identification of key differentiators, reputation of the organization, quality of hireand products and services as delivered by the organization is also major focus of consideration. Defining the right candidate audience is another important element as it helps in identifying the right source to acquire right talent for specific roles. Providing positive outlook and experience to candidate, understanding the various dimensions of candidate community and managing the association with those candidates that are not selected is also an important part of talent acquisition and management. Finally the technology aspect that caters to the understanding of metrics and analytics related to recruitments and gaining insights form those measurements for continuously improving the process so as to make better recruiting decisions will eventually lead to improved quality of hire.

Understanding the Talent Management Theory

According to Miner, (1973) talent management can be broadly defined as the one the most important HR process that is specifically designed for top management positions and is more focused towards drawing and choosing form the most intellectually suitable talent. It also aims at recognizing and evaluating the successful characteristics of a specific individual.

Another common argument proposed by Collings and Mellahi, (2009) states that talent management is the process that involves activities primarily focused on identifying the key areas that have substantial contribution towards achieving the organizational objectives and goals. The

process also involves overall development of the identified talent pool comprising of the high performers and orient them towards a differentiated human resource architecture within the organization so that they are continuously committed towards the organization. Concept of global talent management also comes into picture with major focus being incorporation of global dimensions that includes initiatives such as attracting, selecting, developing, and keeping the best employees in the most important roles worldwide (Vaiman, Scullion, and Collings 2012).

In a study conducted by Stahl et al. (2012), where they have selected organizations that boasts of high performance oriented and have good reputation as employers. Two categories were identified towards understanding talent management. Differentiated approach that cater to limited high potential; employees and inclusive approach that was made available to the employees. It was noteworthy to know that findings clearly stated that organisations do not merely copy existing practices of other top performing companies but they must try to bring a level of alignment in terms of their existing practices, strategies and values. As depicted in the fig.3 six principals of achieving global talent management were highlightes in the study.

Fig 3 Principals of achieving global talent management (Stahl et al. 2012)

Talent management theories have always stressed on the assumptions stating the importance of maximizing the employees' talent being the single most important source for gaining competitive advantage (Scullion et al., 2010). As a result of this talent management has been directly related human resource management practices of an organization aiming at increased business performances (Farndale, Scullion, & Sparrow, 2010). Talent is a very subjective term that requires an undisputed understanding within the HR managers and top management firms as well as they may have different perspectives towards various sources of attaining competitive advantage for the organization. The challenge faced by most of the organisations is the attracting, assessing, training and retaining the talented pool of employees. Hence the organisations can try to identify the existing pool of talent and focus on developing them rather than trying acquire new talent that might lead to exaggerated costs involved.

Major disruptions are observed in the process of talent acquisition and management due to intrusion of technology in the process of hiring. Organisations have been constantly being challenged by social networks, aggressive marketing by the competitor's brands and re-

recruitment of employees every day. The catch here is to understand and select the most suitable technology that will reach right kind of talent and develop a well-planned talent recruitment process aligning organizational goals and objectives.

Hence the present study attempts to understand the traditional acquisition process and the factors responsible for the changing dynamics of talent acquisition and management. Further it is attempted to analyse the influence of leadership, technology, culture and Quality of hire on job retention as well.

Objectives

- To understand the traditional and the modern disruptive talent acquisition and management process.
- To study the influence of modern factors on changing dynamics of talent acquisition and talent management
- To analyse the effect of Culture, Technology, Leadership and Quality of hire on Job retention.

Literature Review

As stated earlier talent acquisition is the procedure of identifying and acquiring skilled employees to meet necessities for the organizational requirements. Srivastava and Bhatnagar (2007) in their case study of Motorola in India, highlighted the impact of due diligence in talent acquisition which is the most crucial problem faced by the organizations in the present times. The practices which are used innovatively by one company become benchmark and soon they are followed by more or less every organization in the industry. But this is important for the organizations to keep their own goals and culture in mind, based upon which they should design their recruitment strategies. One strategy does not support every organization. E-recruiting and web functionalities had become collaborative approach in acquiring and managing talent. The online experience of web browser access, interactive interfaces, social networking, collaboration and community are now commonplace with candidates. Today, Internet users are old and young, male and female, skilled and unskilled. The use of the web for recruiting is no longer confined to professional and salaried positions. Increasingly it is also being used for recruiting for hourly jobs (Philips, 2008). Talent acquisition has evolved from a tactical, back-office process to a strategic endeavor that directly impacts organizational growth. Organizations struggling to identify and attract talent must rethink their current strategies and technology options in order to align with corporate objectives. A detailed survey was conducted with 234 organizations to explore how best-practice organizations build result driven talent acquisition programs, align goal with business objectives and to leverage world class technology to achieve results (Madeline Laureno 2013)

New Sources of Acquiring Talent

In past the process of recruitment was merely posting the openings on the career page of the organisation's website. This is no longer the right way of attracting the right candidate for the job. Companies are now finding unique ways of reaching out to newer talent and accessing the better talent pool using the disruptive technologies. Organisations are now treating recruitment as a drive for marketing their own self. Hence the partner with a corporate marketing firm and develop an integrated approach for attracting new talent. Facebook has no longer remained the only place where they can post job openings. Most of the organisations are going beyond it and leveraging the power of social media by building more robust and active communities over

various other social media platforms like LinkedIn and twitter. In fact the focus has shifted to people and network of people who can become quality recruits.

Use big data to deepen talent networks: Organizations can now leverage big data tools from vendors such as Linked In, Face book, Talent Bin, Work4 and others to identify and source quality candidates around the world. Talent analytics will help in identifying the most important source of talent generation, this will help in determining the best fit that's will eventually improve the quality as well a efficiency of hiring.

Few methods of acquiring and maintaining the quality of hire are by having an active strength of candidate resource so as to make sure in case of any emergency this repository can be utilized. The management of this resource is tricky they need to be constantly engaged so that they can be made into active mode from passive mode if need be. Another important platform is the social media that is a very big source of passive candidates. An aspirant can learn about his prospective employer by just joining the employer community. Table 1 summarizes the new sources of acquiring the talent.

Table 1 Sources of acquiring talent

Activity	Description
Boomerang Rehires	This rehire program is low cost, results in high ROI.
Shift from active tools	Companies need to look for passive job seekers who are too comfortable in their current organization as these are the considered to be the best talents according to the study conducted by Zinnov management Consulting. Capgemini has initiated the use of LinkedIn and Facebook for reaching out to passive seekers.
Mobile Technology	Mobile has transformed the way organisations operate. The Connectivity and opportunity have increased drastically and hence there must be provision for mobile solutions access to both recruiters and candidates.
Talent Acquisition Approach	360 degrees/720 degrees approach for enhancing excellence and empowerment.
Internal Promotion	Organizations must encourage internal promotions by providing employee with management development programs
Employer Branding	Various activities like CSR activities, campus connect activities and other innovative ways to source, develop and retain talent must be employed.
Assessment Centers	Having specific locations for assessing the hiring process.
Maintaining parity	Managing the balance between money and better learning in order to retain talent
Satellite Location Hiring	Having a common location near major cities will help in reaching the candidates who are not able to travel to big cities.
Diversity Hiring	Focus more on having a diversity among the workforce will ensure better workforce dynamics and efficiency.
Increasing focus on Employee Referrals	Referrals are cheaper, quick and better conversion rates in terms of joining the organization.

RESEARCH METHODOLOGY
Statement of Problem
- Most organizations will find themselves competing to acquire high-performers. Hence the primary problem is to understand the existing talent acquisition and management process and the way it is getting disrupted.

- Success will depend on a combination of HR philosophy, how effectively they embrace the web, and how far they can drive through operational efficiencies, particularly in cutting costs and streamlining internal recruitment processes. There for the next research question is with respect to identifying the major factors influencing the present dynamic talent acquisition and management process.
- Based on the identified factors the study attempts to answer the question of the most influencing factor on the dependent variable (Job Retention)

Research Design

The study was aimed at evaluating the impact of culture, technology, leadership, quality of hire on job retention and engagement. Employees and employers working in corporate sector, government sector &self-employed constituted the population for the study. Purposive sampling technique was used to identify responses for the study and a sample size of 150 respondents was taken to conduct the study.Self-designed questionnaire was used for evaluating job retention and engagement of employees. Data was collected on a scale of, where 1 indicated strongly disagree and 5 indicated strongly agree.Cronbach's Alpha reliability was computed using SPSS software to evaluate the reliability of the questionnaire.

RESULTS AND DISCUSSIONS

Table 2: Frequency Distribution

Serial No	Questions	Mean	Standard Deviation
On the basis of Culture			
1	The organization has a positive value system that people understand and believe in.	4.072917	0.797955
2	I believe that I am accepted as part of the team in the organization.	4.312500	0.744276
3	People in the organization have the opportunity to be involved in the decision making process.	3.895833	0.911669
4	I believe the organization is open to change.	3.906250	1.016476
5	People in organization widely share the same philosophy.	3.604167	0.956740
6	I believe the organization offers sufficient job training for employees.	3.843750	0.998189
7	People in organization share a common set of moralprinciples.	3.708333	1.014803
8	I am pleased with the opportunities I have to be promoted in the organization	3.822917	0.870509
9	Company does its fair share to support community projects.	3.770833	0.839538
10	Management values the employees of organization.	3.875000	0.861455
11	Employee's capabilities are fully utilized.	3.947917	0.921895
12	Employees are recognized for good work	3.895833	0.934476
Technology			
1	Recruiters/HR generalists sharing valuable content about the "Brand" i.e. Its culture, values, mission, goals, benefits, training, etc. on social media.	3.968750	0.787443
2	Showcasing the firm's opportunities on the firms careerspage in	3.906250	0.834495

	websites, Face book page about the status updates		
3	Technology used in promoting and strengthening the brand in the market place	3.927083	0.729019
4	Educate workforce on new and upcoming tools, techniques, practices and open source solutions	3.989583	0.760814
5	Develop depth in niche areas like embedded software, Bluetooth, security, chip development etc.	3.916667	0.902239
6	Set up small, independent and agile innovation centers focusing on new products and technology	3.916667	0.866532
Leadership			
1	When assigning tasks, I consider people's skills and interests.	4.460000	0.613122
2	I expect nothing less than top-notch results from people.	3.700000	0.994885
3	I expect my people to work harder than I do.	3.420000	1.341489
4	When someone is upset, I try to understand how he or she is feeling.	4.700000	0.505076
5	When circumstances change, I can struggle to know what to do	4.120000	0.824126
6	I think that personal feelings shouldn't be allowed to get in the way of performance and productivity.	3.980000	1.115567
7	My actions show people what I want from them.	4.000000	0.857143
8	When working with a team, I encourage everyone to work toward the same overall objectives.	4.540000	0.613122
9	I make exceptions to my rules and expectations – it's easier than being the enforcer all the time.	3.840000	0.888934

10	I make time to learn what people need from me, so that they can be successful.	4.500000	0.614452
Quality of Hire			
1	What are your organization biggest recruiting challenges?		
a)	Do you feel finding good candidates are difficult?	3.280000	1.125584
b)	Do you think filling positions fast is challenging?	3.580000	1.011969
c)	Is it difficult to Contact candidates?	2.860000	1.195399
d)	Do you find difficulty in scheduling interviews?	2.780000	1.200170
e)	Is sourcing resumes stressful?	3.200000	1.106567
2	Do you consider the reference check as an integral part of recruitment?	3.840000	1.113186
3	Do you consistently appoint high calibre employees?	3.560000	0.951047
4	Do you ensure that vacancies do not remain open for long period of time?	3.640000	1.208136
5	Are all company interviewers trained to sell our employer brand?	3.440000	1.231558
Job Retention			
1	Is talent acquisition truly working with other corporate departments	3.840000	0.976458

	in delivering the employer branding?		
2	Are we working with our in-house employee groups to improve our candidate experience and on-boarding programs?	3.760000	1.060612
3	Do you believe that transfer, demotion, suspension anddismissal are based on performance appraisals?	3.520000	1.182181
4	Is your company lacking, fairness in supervision and inconsistency in employment opportunities, having an impact on employee retention?	3.460000	1.146601
5	Do you believe that cash incentives have more of the contribution in employee retention activity?	4.140000	0.926041

Culture:From the above table 2 we can interpret that Mean contributes **46.6562** on the scaleof 1 being the lowest and 5 being the highest and Standard deviation contributes **10.867981** to the culture of the organisation.

Technology:From the above table 2 we can interpret that Mean contributes**23.625**on the scaleof 1 being the lowest and 5 being the highest and Standard deviation contributes**4.880542**to the technology of the organisation.

Leadership:From the above table 2 we can interpret that Mean contributes**41.26** on the scaleof 1 being the lowest and 5 being the highest and Standard deviation contributes**8.3679**to the leadership of the organisation.

Quality of hire:From the above table 2 we can interpret that Mean contributes**30.18**on thescale of 1 being the lowest and 5 being the highest and Standard deviation contributes**10.1436**to the quality of hire of the organisation.

Job retention and engagement:From the above table 2 we can interpret that Meancontributes**18.72** on the scale of 1 being the lowest and 5 being the highest and Standard deviation contributes**5.2918**to the job retention and engagement of the organisation.

Factor Analysis

Kaiser - Meyer - Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity (KMO):

The Kaiser - Meyer - Olkin Measure of Sampling Adequacy value was 0. .783 indicating that the sample was adequate to consider the data as normally distributed. The Bartlett's Test of Sphericity tests the null hypothesis that the item-to-item correlation matrix was an identity matrix. The hypothesis was tested through Chi-Square test; the value of Chi-square was found to be 2172.554, which is significant at 1 per cent level of significance. Therefore, null hypothesis is rejected; indicating that the item-to-item correlation matrix is not an identity matrix and is therefore suitable for factor analysis as shown in Table 3.

Table 3KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.783
Bartlett's Test of Sphericity	Approx. Chi-Square	2172.554
	df	861
	Sig.	.000

RELIABILITY TEST

Cronbach's Alpha reliability method was applied to check the reliability of all items in the employee and employer questionnaire. The reliability coefficient value was well within the required range which depicts high reliability of the questionnaire. Reliability test was applied using SPSS software and the reliability test measures are given below in table 5:

Table 4 Reliability Scores

Sl. No.	Construct		No. of Items	Cronbach's Alpha
1	Culture	(C1)	12	0.907
2	Technology	(T1)	6	0.843
3	Leadership	(L1)	10	0.724
4	Quality of Hire	(Q1)	9	0.836
5	Job Retention	(J1)	5	0.729

Testing Of Hypothesis Findings and Results

It is assumed that the Talent acquisition is influenced by various factorsTo find the influence of various factors on job retention regression analysis was carried out. Regressions analysis is conducted in order to identify the combined effect of all the factors (Independent variables/ predictors) on the outcome variable (dependent variable). The predictor variables are added using the enter method to the proposed model. T statistics are used for determine the significance of the predictor variables on outcome variables.

Ho: There is no significance influence of Culture (C1), technology (T1), Quality of hire (Q1) and leadership (L1) on Job Retention (J1)

To examine this relationship linear regression is carried out using SPSS 21 and the values R2 and Adjusted R2, Unstandardized β and corresponding significance levels are noted down for ascertaining the proposed model.

Regression

Table 5Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.377[a]	.142	.104	.62107

a. Predictors: (Constant), Q1, T1, L1, C1

Table 6ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.806	4	1.451	3.763	.007[b]
	Residual	35.101	91	.386		
	Total	40.906	95			

a. Dependent Variable: J1

b. Predictors: (Constant), Q1, T1, L1, C1

Table 7Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	2.188	.767		2.854	.005
C1	.171	.138	.167	1.243	.217
T1	-.181	.144	-.168	-1.259	.211
L1	.137	.171	.081	.804	.424
Q1	.308	.095	.324	3.232	.002

a. Dependent Variable: J1

Findings

From the above analysis we have estimated mean and standard deviation from frequency distribution, communality test, and the KMO test tell that the sample is adequate

From the regression analysis it is evident that model is able to predict 37.3 percent of total variances shown in table 6. From the Anova table 7 the proposed model was found to be significantly able to predict the proposed job retention model as $p<0.05$. Which lead to rejection of null hypothesis and acceptance of alternative hypothesis that there is a significance influence of factors on job retention.

On further evaluation of coefficients table 8, it is evident that of the four factors that were taken as predictor variables only quality of hire is significantly contributing to the model (Unstandardized $\beta= 0.308$, Sig= 0.002; $p<0.05$). This implies that the hiring process is very important and organizations must develop robust processes in order to identify the right source and right target candidate.With the appearance of new trends and the opening of new tools, the talent acquisition process is continuously evolving. Its future sits on technology and third parties like consulting practices, search firms, recruitment process outsourcing, and more.

Implications of Talent Acquisition and Management

Hence the study highlights the most important factors influencing the talent acquisition and management is quality of hire. The recommendations are hence very clear that the organisations must find creative and innovative ways to identify the right source and reach right target candidates. Identify clearly the available resources and missing skills needed to compliment the current competencies and plan the recruitment process accordingly. It is very important to decode these traits in order to reach the right requirements of the workforce. Market of job requirements must be done in creative way so that it reaches the right candidates with right skills. Create a widespread referral network as these can help in getting the most suitable workforce for the specific jobs which will also save lot of time and money. Recent hired employees, collaborations with the organisations, candidates who are no longer a part of the company are all the prospective point of contact for strong referral network. Attach rewards, referral programs,

redemptions prizes, cash awards as incentives that can be rolled out in case of successful referrals. Revampthe application process, decrease your workload and discover the accurate people for open positions quicklyallowing interested job seekers to create a 'profile' of themselves. Additional information can be gathered which is specific to company's hiring objectives, and turn the workload in company's favor by not having to answer to everyindividual application. This way, the talent pool can be built exponentially and organisations can have a ready source to always for existing and upcoming position openings.

Conclusion

Major challenge in today's talent acquisition and management process is global abundance of candidates but scarce local talent. More number of older employees and less younger employees also makes it difficult for the organisations to plan for future as most of the employees are nearing retirement age. Diversity of workforce and workplace which makes it difficult for managers to manage all of them at once. Technology is proving to be major enabler for effectively managing talent. This will henceforth be more dependent on supply chain management principles as based on the requirements generated by the system the hiring process can be carried out. Talent Acquisition will also see a major change as these process will now be automated and probably outsourced to third party in order to reduce cost and time involved. Functions like payroll are already being done away with. Since talent acquisition is an important and key business activity for most of the organisations the HR functions will have to derive long term strategic plans to actually benefit from it. The overall profitability of the organisations will and its corporate success will depend on it.

Scope for future research:

Future scope of work may be focused on understanding the new theories that will impact job retention and how these insights can help in development of talent management. New evolving models talent acquisition and management and its impact on global diversity will also contribute to good study. The individual, organizational and macro-contextual hindrances in managing and acquiring the talent and ways to overcome it will also be important piece of study. Impact of such developments on international business and the management of the same will need to be studied in detail. Roles and responsibilities of corporate, educational stakeholders and governments in improving the talent acquisition and management process will also be a good scope of future study.

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THE EFFECTIVENESS AND UPTAKE OF EXPERIENTIAL LEARNING METHODOLOGIES WITHIN MULTINATIONAL ORGANIZATIONS IN INDIA

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ABSTRACT:

Organizational development is a planned effort for a work group and/or the organization, managed by leadership and supported by employees, to increase organization effectiveness through planned change in processes and systems[1]. This paper deals with "learn by doing" method of learning and development in the corporate space in India. It explores opportunities of carrying out experiential learning in India especially in Multinational Companies and also the constraints and challenges in the business of Learning and Development. This paper concludes with some findings and suggestions for policy changes.

INTRODUCTION:

Any company profits mainly from the skill, labor, mental prowess, negotiation skills and other such factors attributed to its employees or workforce. An organization may fail at various levels and points in case any of these factors are either completely lacking or partially missing. It is therefore imperative for any organization to take a step back and periodically evaluate the skill, interest, aptitude, ability and such other tangible and intangible assets within the company. It is sometimes also necessary to look at these factors outside of the company, especially when there are dependencies of skill or decision beyond the ambit of the organizational periphery. This is more so relevant for any company that engages in outsourcing or giving orders outside on project, time or turn-key basis.

In this paper we shall delve into the different learning approaches and their impact. Moreover, we shall focus on experiential learning and how its impact and retention might far surpass other methods of learning.

We shall also focus on retention and inclination as the third aspect. Finally, we shall conclude with differences in spending patterns of companies in India and abroad on the same aspect of learning and organizational development.

THE IMPORTANCE OF LEARNING AND ORGANIZATIONAL DEVELOPMENT:

A learning and development strategy outlines how an organization develops its workforce's capabilities, skills and competencies to remain successful. It's said that it is an important part of an organization's overall business strategy and its policies (2). Usually, learning and development is a department within the Human Resources department in the company. Any competency assessment, skill development or imparting of skill and any other talent management

tasks falls within the ambit of the learning and development department. Hence, the importance of this function is unprecedented. Any lapse on the part of this function would be fatal to the progress of any organization. Since it handles competency as well, it is crucial for the future as all progress is mainly a factor of skill, talent, learning and keeping up with changing technology and developing one's skills.

SCOPE OF EXPERIENTIAL LEARNING AND DEVELOPMENT IN AN ORGANIZATION:

Most, if not all, organizations have a dedicated learning and development division which is usually a sub-function within the Human Resources vertical. It is not uncommon for the HR team to handle organizational learning without the need of a separate team. This paper would cover the approaches, benefits, challenges and related parameters for organizations who wish to launch or continue experiential learning using outbound activities, simulations or just experiential games.

It is, however, imperative to note that not all organizational learning outcomes can be achieved using the experiential approach. If the necessity of the training is skill based or particular proprietary software or methods specific to the organization are to be taught, then this approach might not be the most suited one.

TYPES OF LEARNING METHODS:

There are mainly 7 different learning methods. They are:

  a. Lecture in a classroom
  b. Reading material: Books, brochures and other paraphernalia
  c. Audiovisual: Documentary or explainer videos
  d. Demonstration: Someone showing you how it's done.
  e. Discussion: Includes debates, group discussions, forums and discussion groups.
  f. Practice Doing it yourself
  g. Teach others how it's done

Jeffrey Pfeffer and Robert Sutton[3] argued that the gap between knowing and doing is greater than that between ignorance and knowing. Notice that the word knowing appears on both sides. Hence, here the important keyword is "doing". When one does it, retention is much higher.

The same is represented in many kinds of pyramid shaped indicators for retention levels. We are all familiar with this one:

Learning Pyramid

average student retention rates

	Lecture
10%	Reading
20%	Audiovisual
30%	Demonstration
50%	Discussion
75%	Practice doing
90%	Teach others
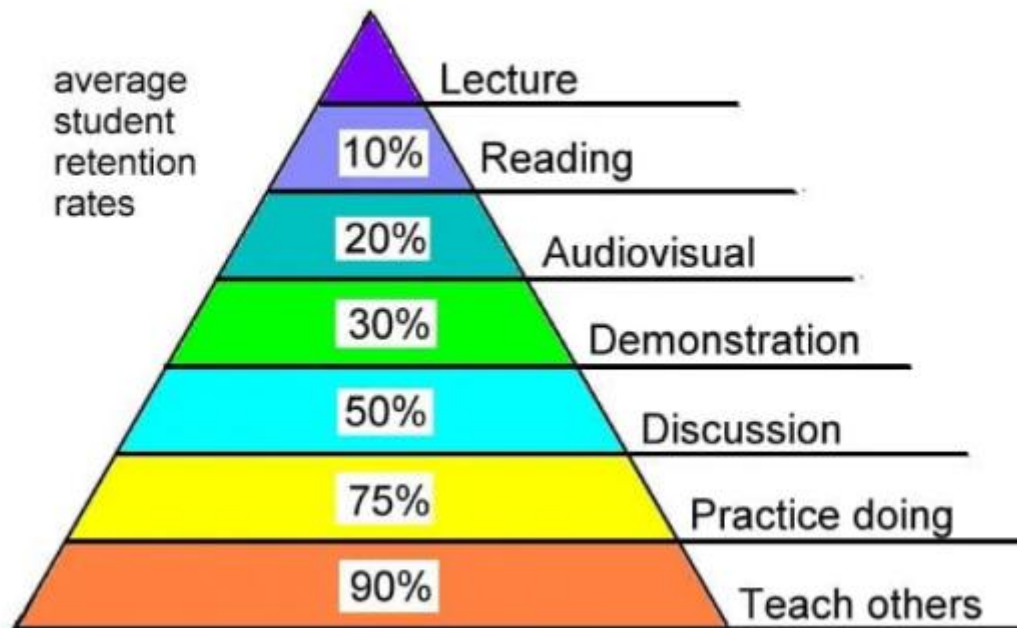
Source: National Training Laboratories, Bethel, Maine

It is not very debatable anymore as to which learning methodology works best.

Notice that apart from teaching, which is not always a viable option in the corporate world, the 'Practice doing' method is way better than any other learning method. Sadly, in most organizations we still implement the same lecture or audio-visual method.

Other terms for "Practice doing" may include "Learn by doing", "Experiential learning", "Gamification", "Simulation based learning", etc. In any form or shape the terminology still means a synonym for learning by practicing or by doing it

However, its implementation still leaves a lot to be desired in most organizations.

In a 2014 survey including 551 respondents mainly from the learning space, about half indicated their willingness to implement gamification into their organization's learning protocol.

The graph, then, looked something like this [5]:

LEARNING FUNCTIONS USING GAMIFICATION OR SERIOUS GAMES ARE IN THE MINORITY

Which of the following describes your organization's use of gamification and serious games?
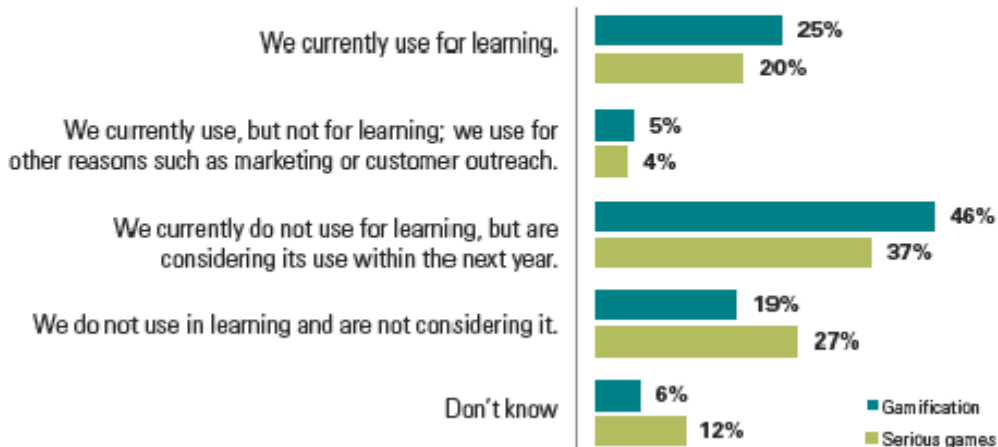
While most companies thought very highly of experiential learning, they had the intent, but did not exactly know how to implement it. Most companies wanted to implement it, but seemed lost in the method of implementation.

APPLICATION OF LEARNING METHODS IN ORGANISATIONS:

The need for a simulated environment in any organization is vastly understated. Back in school or during one's academic learning, it would be ok, or even encouraged, for the learner to make mistakes and to learn from one's mistakes. In fact, that is one of the recommended methods of learning. i.e. Practicals. Practicals far beat their theory counterpart in retention. This is why most institutions have a separate time for theory and practicals demarked clearly.

But would making similar mistakes back at the job be a viable option?

Imagine a person in the banking industry designated to handle decisions or transactions worth hundreds, thousands or millions of dollars, makes a mistake. The learning is great, but at an unimaginable cost. The need for creating a simulated environment where one can freely make mistakes and change his or her decision on the fly and see the impact of each lever on the business metrics is urgent and now. Companies that invest in simulation based or experiential learning are known to put their employees in key decision making positions or strategy planners through intense simulation programs where they understand the impact of one decision on many other parameters.

OPPORTUNITIES FOR SIMULATION BASED LEARNING IN INDIA:

India, as an economy is known for a few niche things like software development, space research, analytical abilities, etc. Companies like ISRO and countless software development houses, big data analysts thrive in India.

It would be crucial for such companies who cannot afford their employees to make mistakes back at the job, to create a safe, sandboxed, simulated environment for them to try out newer things and see how things go.

Many companies are trying to change their focus from conventional lecture based classroom training to more interesting types.

Classroom training using PowerPoint is colloquially called "death by PowerPoint" by employees who are now sick of looking at the projector, presentation after presentation. It is even more boring when the presenter simply reads from the slide. Given this background, the demand for experiential learning has catapulted this learning methodology to the forefront of any other type of learning. A simple attendance to such types of learning interventions speaks volumes about its efficacy and the interest it creates in the target audience.

CHALLENGES IN SIMULATION BASED LEARNING AND DEVELOPMENT IN INDIA:

The single biggest challenge that any company faces when trying to transition from the legacy PowerPoint approach to experiential models of gamification is budget. Any approach to make the experience gamified would surely cost more than a single presentation that can be rolled out to tens of people in a room. Companies are sometimes weary of spending on their employees. More so, we notice a vicious circle in which a company does not invest in making their learning and development interesting because it has a high attrition rate. Ironically, a major part of that attrition is attributed to people not finding enough to learn from their company. This leads to more attrition, which, in turn, validates the HR manager's claim.

The second challenge would be the availability of space. When participants have a gamified experience, they are usually divided in teams. This would surely take up more space than a theater seating for a crowded audience.

Crowd control is another skill essential in a clustered simulation arrangement. If people are seated in a line, facing the stage, they are easy to spot and all eyes are on the screen.

Availability of an outdoor venue is also sometimes a pre-requisite of the experiential intervention, especially if it is a team building and collaboration workshop.

Finally, there is always unwillingness from the manager to spare employees. This is more so true when teams have ambitious goals and each day is critical to the success of the project. Sparing employees for a day (or three) is sometimes regarded as a waste of time and resources. Not to mention the department's budget as well.

CONCLUSION:
In conclusion, some observations are noteworthy in the logical progression for the implementation of Simulation based or Gamified learning in any organization. They may be summed up as:

1. Most organizations acknowledge the need for experiential learning
2. Although the benefits of experiential learning are understood and recognized, some companies still shy away from implementing it.

3. Companies have a fear of the unknown to transition to experiential learning.
4. Increase in budget is the single biggest deterrent to companies to implement experiential learning.
5. The benefits, albeit far outweighing the cons is little understood by the companies because the expense and effort is tangible, whereas the outcome in the form of lesser attrition, boosting employee morale, making a cohesive team, enhancing employee motivation, etc. are intangible outcomes
6. Other barriers that need to be overcome are language barriers, comfort zone with PowerPoint presentations, legacy culture of lecture based training.

RECOMMENDATIONS TO POLICY MAKERS:

1. Just like policies for office attendance, harassment, maternity, etc. are well defined, a clear policy of employee learning should be in place.
2. There should be a clearly demarked time allocated to experiential learning that every employee must go through.
3. Employee buy-in and preference should be the basis of this elective.
4. Management should allow a leeway to employees investing their time in simulation based learning, just as they do for other mandated leaves. This encourages employees to not short-change learning time for project deadlines that are an ongoing affair.
5. Similar to other committees, there should be a grievance redressal committee in the organization for employees who feel they are intellectually stagnating and wish to enhance their skillsets aligned with their job role.

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A STUDY ON THE MINUTIAE BASED EXTRACTION FOR FINGERPRINT MATCHING

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ABSTRACT

With the advancement of the technology and development of internet, now it has become much easier to access the information. Here, the main concern is related to the security of user information where the need of having a technique for proper authentication of the users is growing.   In recent years, the usage of alphanumerical usernames and passwords in terms of the common authentication technique has increased.

The system of password authentication is not complex as there is just a need of entering correct password to be recognized as an authenticate user. Also, the fingerprint user authentication technique is in trend which provides more strength to the current authentication security. But here, the limitation of this type of authentication is that the authentication key can't be changed by a user himself/herself. The current paper highlights the minutiae based extraction for the fingerprint matching.

KEYWORDS: Fingerprint, Biometric, Authentication

INTRODUCTION

With the help of the authentication procedure of the users, the identification validity of a user can be checked easily. Here, a biometric device is used for the authentication of the users. There are three types of this mode of authentication of users. User knowledge based authentication method is first type of authentication method. In this type of authentication, the users have to remember the passwords set by them and at the time of authentication, they have to provide the correct password, otherwise, their authentication is failed. This type of authentication system is widely popular as it is much easier to implement and it provides good services.

In next type of authentication method, the smart cards or access cards are used in order to precede the process of user authentication. In another mode of authentication technique, the physical features of a user and fingerprints are used for recognition.

A fingerprint is just like a pattern which is comprised of lines of uplifted pores on the palm. Figure 1 shows the fingerprint mark image where uplifted lines are known as ridges and valley is the part which is caved between two ridges. Hence, it can be said that a fingerprint is the collection of ridges and valleys which are appeared at the end of a finger. In the process of recognizing the fingerprint, the analysis of the flow of ridges is performed.

Here, feature is the biometric information which is needed for the purpose of recognizing a user. Minutia is the collection of features which tend to appear in fingerprints. There are two types of minutia i.e. ending and bifurcation. Here, the part where the ridge flow tends to be cut down is known as ending and in bifurcation, two ridges come together to form a single ridge. Generally, there are more than one bifurcation and ending in one fingerprint image.
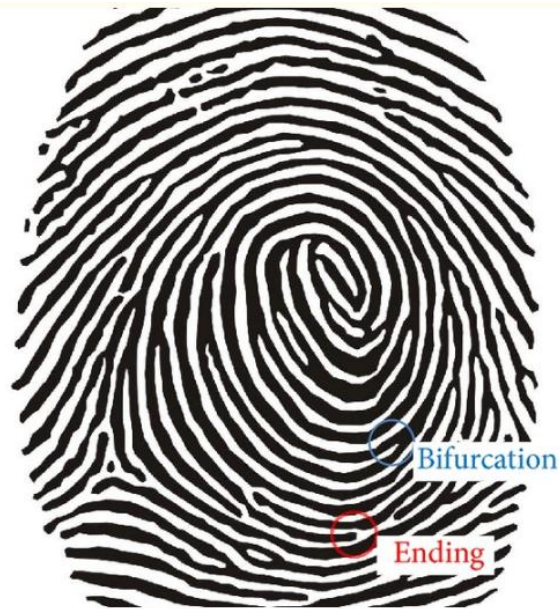
Figure 1: Elements of fingerprint

The place of this ending and bifurcation plays a major role in identifying a user as they serve as the basic elements of the biometric authentication system.

MINUTIAE BASED EXTRACTION FOR FINGERPRINT MATCHING

There is some vulnerability regarding the security issues of the authentication system based on fingerprint matching such as the key related to the authentication of a user can't be changed in this type of authentication system.

There should be some criteria to change the user authentication key in biometric as in this system, user's confidential information i.e. fingerprints are stored and in the situation of leaking this precious information, a user should have the functionality to change the authentication key so that no unknown person can misuse the leaked biometric information.
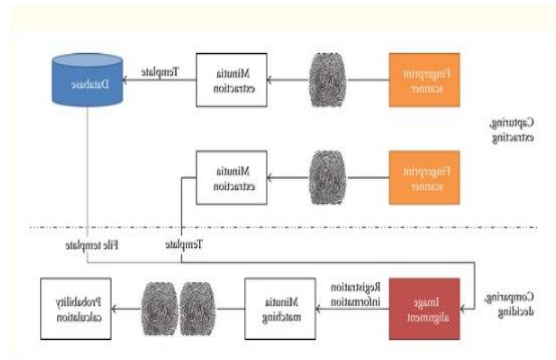
Figure 2: User authentication mechanism using fingerprint

Figure 2 depicts that there are two main steps in the methodology of recognizing fingerprint i.e. feature extraction and fingerprint matching. In the step of feature extraction, the data files related to the minutiae are configured in the matching of fingerprint which is further processed in further three steps that are preprocessing, minutiae extraction, post-processing, as shown in Figure 3.
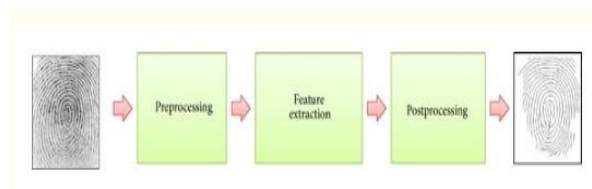
Figure 3: Fingerprint Recognition Procedures

1. Preprocessing

1.1. Image Improvement

The classification of the fingerprint image is done with noises. It is observed that a lot of physical changes are appeared on the fingerprints due to the involvement of the injuries or moisture. Hence, noises are mixed with the images of the fingerprints obtained through the devices. Here, the noise is reduced to clarify the identification of ridges and valleys in the step of improving the image. For this purpose, the adaptive filters are used to enhance the quality of the fingerprint.

It uses the fact that if knowing ridge local orientation around applied pixels and applying adaptive filter, ridges with the same direction become clear. In this process, the bridge of neighboring rides resulting from noises is removed and the result of connecting broken ridges is often shown. Directional Fourier filter, Gabor filter and so forth, are widely used adaptive filters, and the method using mask operation is also used.

1.2. Binarization

When image improvement work is finished, the process of extracting ridges is started. As shown in Figure 4, fingerprint images usually have grayscale of 256 but this can be simplified into the binary information of ridges and valleys as binarized image of Figure 4(b).
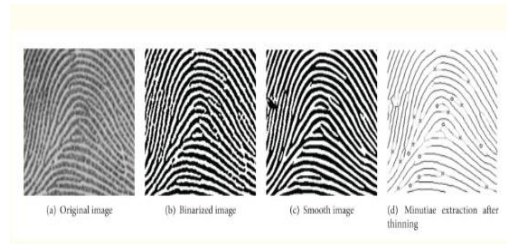
Figure 4: Preprocessing of fingerprint recognition

There is a difficulty that binarization cannot be done by using single intensity threshold because all fingerprint images do not have constant image contrast in the process of making binary images, and even the contrast ratio of the same person's fingerprints varies every time the device is pressed on. Therefore, the dynamic thresholding method is applied depending on image distribution pixel values and through it, the whole image is binarized into the ridge part and non-ridge part.

1.3. Thinning

The final step of preprocessing to extract minutiae is the thinning step and this refers to the work reducing the width of ridges obtained after binarization into one pixel like minutiae extraction after thinning of Figure 4(d).

This process must not only fully maintain co-connectivity of found ridges but minimize wrong minutiae information that may occur through this step. As can be seen in Figure 4(c) smoothened image, the flow of ridges becomes often clear by applying the smoothing technique to binary images. Many algorithms have been using this method because minutiae can be found quickly and easily through simple mask operations with thinned fingerprint images.

Preprocessing is the relatively time-consuming process. Since time consumption in the process of using adaptive filters and thinning accounts for the largest part, research on the algorithm which can ensure a high recognition rate while reducing the operation time of these two steps is needed.

2. Feature Extraction

After preprocessing is finished, the process of finding minutiae is carried out. As shown in Figure 5, by using thinned images, minutiae is distinguished by finding a point where a thin line ends for an endpoint and the point where three thin lines meet for bifurcation.
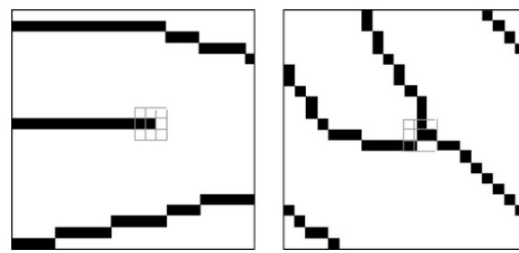
Figure 5: Feature extraction of fingerprint recognition

3. Post-processing

The false minutia caused by the damage of the original image is included in the found minutiae and these are called false minutiae. Most false minutiae are created by incorrectly thinning the part where ridges are broken due to injuries and so forth, or the part where the shape of ridges is not shown well due to changes in binding force. By defining and removing false minutiae, post-processing plays a role of reducing unnecessary operations in matching and increasing overall performance.

CONCLUSION

With the rapid growth of computer and communication technology, users have access to information easier. Easier access to information, but the threat of information leakage has become increase. The personal authentication system is required, while providing information about the safety and security.

In this study, user authentication was performed that use biometric information and passwords of users. The user cannot change user's fingerprint information, but the user has a set password to easily change. So this authentication system provides security and flexibility.

Because it can make a password key that utilize the user's fingerprint and numeric password, an attacker does not have the advantage of leaked password.

In addition, it can remove authentication errors that recognize fingerprints among different users for the feature extraction results of two different users.

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A STUDY ON INVESTMENT PREFERENCES AND PORTFOLIO MANAGEMENT OF ACADEMICIANS IN CHENNAI

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1. INTRODUCTION

The developing countries like India face the enormous task of finding sufficient capital in their development efforts. Most of these countries find it difficult to get out of the -vicious circle of poverty of low income, low saving, low investment, low employment etc. With high capital output ratio, India needs very high rates of saving and investments to make a leap forward in her efforts of attaining high levels of growth. Since the beginning of planning, the emphasis was on saving and capital formation as the primary instruments of economic growth and increase in national income. In order to have production as per target, capital formation was considered the crucial determinant and capital formation had to be supported by appropriate volume of saving. Growth will set in motion a self reinforcing process by which investment is encouraged, investment enhances growth and increased income raises saving. As Rao (1980)' has rightly pointed out, "increase in saving, use of increased saving for increased capital formation, use of increased capital formation for increased saving for a further increase in capital formation constituted the strategy behind economic: growth. This process of increased capital formation leading to increased saving and increased saving leading to increased capital formation will continue t:.ll saving, capital formation and income reach desired ' Rao, VKRV (1980), Op.cit., p.965. levels after which saving and capital formation gets stabilised and there would be a steady and self sustaining increase in national income.An academician is a person who is generally denoted by the term 'scholar' who holds an advanced degree in their specialization. She/he is a respected person who has attained Mastery in research discipline. They are the influencers of many around them especially the vibrant adult of the nation.

Most people in their later stage of life realize that the financial strain suffered by them could have been avoided if they had started saving or had invested wisely with a wide portfolio. It takes very little to ensure financial security if one begins to plan her/ his investment portfolio timely and wisely.

My study on the investment behaviour of academicians focuses on- (a)How the academicians are managing their investment portfolio, (b)Are they aware about the investment options available to them, (c)Which is the most preferred one and why.

The aim of my research is to analyze the decision making pattern that currently characterizes academicians' attitude towards investment.

2. REVIEW OF LITERATURE

Shanthi and Murugeasan (2016) concluded that there is no relationship between education with investment while there is a significant relationship between age and income. On the other hand N.S.Shukla (2016) found that there is no relationship between education with investment while there is significant relationship between Age and Income.

Priya Vasagadekar (2014) on working women she concluded that because of the education, now days' women are getting the best job offers with high remuneration. It has become the present day need for working women in India to increase their wealth. As most of the women are low in financial literacy, it becomes hardly possible for them to manage their investment activities on their own. Also the risk taking level of working women in India is low. This is due to shortage of sound financial knowledge.

Rajeshwari Jain (2014) finds that working women have a preference to invest fixed deposit in bank a safe investment option & for tax saving purpose who also indicated that women also select gold as good investment alternative to bank deposit. Study on Perception of Women Investors towards Investments

Kanagaraj et al. (2014) concludes, occupation and educational level does not influence awareness of women investors in Coimbatore city.

Sellappan et al. (2013) further suggest that married women are highly interested in making investment than the unmarried. As well as the younger are significantly interested to invest in stock market, insurance and bank fixed deposits as the elder women. The middle age persons wish to invest in real estate source of investment.

Puneet Bhushan & Yajulu Medury (2013) indicated that women are more traditional and take less risk and significant gender differences occur in investment preferences for insurance, fixed deposits and market investments among employees.

The research study of Elisa C., Gloria G. and Ugo Rigoni (2012) was experimental, which conducted by the help of Laboratory of Experimental Economics of Ca' Foscari University of Venice. This research paper focused on financial education of individuals to getting proper knows how about investment in securities and measuring their risk level. Proper education is necessary for individuals to make diversify investments. Individuals who don't have high income depend on their investments so they are required to allocate their assets properly for diversified portfolio. 200 questionnaires were used for collected data of research study. The results of this research study clearly describe that financial literacy had positive relationship with risk level of individual persons. It's also described that proper education cause's low risk securities investment. This study recommends that government should started financial education programs to give proper awareness to the individuals for investment.

Chitra and Sreedevi (2011) analyzed the influence of seven personality traits—emotional stability, extraversion, risk, return, agreeability, conscientiousness and reasoning—on the choice of the investment pattern. The results of the study show that these personality traits of the investors have an impact on the individuals while taking decisions and also have a strong influence on determining the method of investment. The study found that the influence of personality traits on the investment decision is more compared to that of demographic variables

Geetha and Ramesh (2011) conducted a research in India on people's behavior about investment preferences. There were lot of options for investment like equity, mutual bonds, company funds, gold/silver, bank deposits, real estate and life insurance etc. But people prefer them according to their choices which were most appropriate and suitable for them. This studies show that how people plan to their investment to meet their objectives and goals. Questionnaire was used to conduct the research and the sample size of this study is 210. They check people preferences according to their age, income, education, savings and gender. This study find that the people were not properly aware to the investment options, they have lack of knowledge about risky and less risky securities.

Agrawal (2009) noted that there is no significant difference between male and female investors in the expected rate of return. Nagpal and Bodla (2009) studied the lifestyle characteristics of the respondents and their influence on investment preferences. The study concludes that investors' lifestyle predominantly decides the risk taking capacity of investors. The study found that inspite of the phenomenal growth in the security market, the individual investors prefer less risky investments, viz., life insurance policies, fixed deposits with banks and post office, PPF and NSC.

Davar and Gill (2009) investigated the underlying dimensions in the selection of different investment avenues for the households. The results of the study revealed emphasis on familiarity, satisfaction, opinion and demographic dimensions for all investment avenues.

Prasad (2009) examined the perception of the investors and their awareness on various investment alternatives available. A sample of 100 investors has been taken from the twin cities of Hyderabad and Secunderabad. The result of findings showed 75% Net traders were using online stock trading requiring strong technology base whereas Traditional traders felt online trading not an acute process of stock trading and they didn't participate in net trading due to risk of a system failure. Sunil Gupta (2008) the investment pattern among different groups in Shimla had revealed a clear as well as a complex picture. The complex picture means that the people are not aware about the different investment avenues and they did not respond positively, probably it was difficult for them to understand the different avenues. The study showed that the more investors in the city prefer to deposit their surplus in banks, post offices, fixed deposits, saving accounts and different UTI schemes, etc. The attitude of the investors towards the securities in general was bleak, though service and professional class is going in for investment in shares, debentures and in different mutual fund schemes. As far as the investments are concerned, people put their surplus in banks, past offices and other government agencies. Most of the horticulturists in Shimla city who belong to Apple belt though being rich have a tendency of investing then surpluses in fixed deposits of banks, provident funds, Post Office savings, real estates, etc. for want of safety and suitability of returns.

Gupta and Jain (2008) on the basis of an all-India survey of 1463 households found the preferences of investors among the major categories of financial assets, such as investment in shares, indirect investment through various types of mutual fund schemes, other investment types such as exchange-traded gold fund, bank fixed deposits and government savings schemes. The study provides interesting information about how the investors' attitude towards various investment types are related to their income and age, their portfolio diversification practices, and the over-all quality of market regulation as viewed by theinvestors themselves.

Verma (2008) studied the effect of demographics and personality on investment choice among Indian investors and found that mutual funds were popular amongst professionals, students and the self employed. Retirees displayed their risk aversion by not investing in mutual funds and equity shares. It was also found that higher the education, higher was the level of understanding of investment complexities. Graduates and above in qualification preferred to invest in equity shares as well as mutual funds.

According to Clark and Strauss, (2008) it has been observed that women are more risk averse than men; the young are more risk seeking than the old; wealthier individuals showcase a greater willingness to invest in equities and the poor are risk adverse securities.

Shobhana et al. (2006) have carried out a study on investor's awareness and preferences. They examined the level of investor awareness regarding investment choice and investment risks. The study discovered that the investment in real estate is preferred by a popular of the respondents.

Karthikeyan (2001) has conducted research on Small Investors Perception on Post office Saving Schemes and found that there was significant difference among the four age groups, in the level of awareness for kisan vikas patra (KVP), National Savings Scheme (NSS), and deposit Scheme for Retired Employees (DSRE),and the Overall Score Confirmed that the level of awareness among investors in the old age group was higher than in those of young age group.

Gupta et al. (2001) studied the Indian household investors' preferences, future intentions and experiences and found that bonds were regarded as an investment for the retired people but that did not have much appeal for young people. The market penetration achieved by mutual funds was found to be much lower than equity shares for all age classes.

3. **OBJECTIVES OF THE STUDY**
   a) Find out the portfolio management of the academicians.
   b) Study the level of awareness of the various investment options and most preferred option.
   c) Study the influence of reference groups and the middlemen in investment decision.
   d) Find out the reason for non-investment.
   e) Analyze the risk tolerance level of the individual investors and its co-ordination with their age and income level.
   f) Compare different investment instruments on the basis of risk and return profile and tax saving etc.

4. **HYPOTHESIS OF THE STUDY**
   - There is no significant association between the Age and the Investment preference.
   - There is no significant association between the stream of specialization and the investment preference.

- There is no significant association between the Level of influence and the individual decision making.

5. RESEARCH METHODOLOGY

Research methodology is a method to solve the research problem research systematically. It involves gathering data, use of statistical techniques, interpretations and drawing conclusions about research data. Keeping in view the objectives of the study, data is collected from the following sources. Source of data are:

- Primary data
- Secondary data

Primary data - The primary data is collected by using primary methods such as questionnaires. For this study questionnaires are used to collect primary data from the respondents.

Secondary data - Secondary data collected from various journals, websites and other research reports.

Sample size

Under this research 79 respondents in Chennai opinion are being to obtained on the basis of convenient sampling method.

6. ANALYSIS AND INTERPRETATION

CHI SQUARE TEST: I

Test of association between age and the investment objective.

H0: There is no significant association between the age and the investment objective.

H1: There is no significant association between the age and the investment objective.

TABLE

age * objective Crosstabulation

		objective						Total
		cap reser	cap appri	liqu	inflation\	current inco	tax	
age	below 30	0	0	0	1	1	1	3
	31-40	5	8	5	2	3	6	29
	41-50	5	9	5	3	2	5	29
	above 51	2	9	1	1	0	0	13
Total		12	26	11	7	6	12	74

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.353[a]	15	.359
Likelihood Ratio	18.766	15	.225
Linear-by-Linear Association	6.734	1	.009
N of Valid Cases	74		

a. 22 cells (91.7%) have expected count less than 5.
The minimum expected count is .24.

The calculated value = 0.359

Inference:

The above table indicates that Pearson's Chi- square value = 0.359 is greater than the significance level 0.005, so the nll hypothesis (H0) is accepted.

There is significant association between age and the investment objective.

CHI-SQUARE TEST: II

Test of association between level of income and the gestation period.

H0: There is no significant association between the level of income and the gestation period.

H1: There is significant association between the level of income and the gestation period.

TABLE

annual income * gestper Crosstabulation

		gestper				Total
		less 3 mon	4 to 6	7m to 1 yr	1 to 2 yrs	
annual income	60k to 1lk	1	0	0	0	1
	1lk to 2lk	2	1	0	0	3
	2lk to 3lk	4	8	2	2	16
	3lk to 5	10	6	3	3	22
	5lk to 8lk	3	2	3	0	8
	above 8lk	1	2	1	2	6
Total		22	27	13	12	74

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	35.337[a]	21	.026
Likelihood Ratio	33.642	21	.040
Linear-by-Linear Association	8.376	1	.004
N of Valid Cases	74		

a. 28 cells (87.5%) have expected count less than 5.
The minimum expected count is .16.

The calculated value of H = .026

Inference:

The above table indicates that Pearson's chi-square value = 0.026 is lesser than the significance level 0.05 so the null hypothesis (H0) is rejected.

There is significant association between annual income and gestation period.

CHI-SQUARW TEST: III

Test of association between age and the factors of influence.

H0: There is no significant association between age and the factors of influence.

H1: There is significant association between age and the factors of influence.

TABLE

age * factinfl Crosstabulation

		factinfl					Total
		Own	friends	family	media	mag	
Age	below 30	0	1	1	0	1	3
	31-40	6	9	5	3	6	29
	41-50	6	5	10	3	5	29
	above 51	4	1	5	1	2	13
Total		16	16	21	7	14	74

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.999[a]	12	.858
Likelihood Ratio	8.192	12	.770
Linear-by-Linear Association	.163	1	.686
N of Valid Cases	74		

a. 12 cells (60.0%) have expected count less than 5. The minimum expected count is .28.

The calculated value H= 0.858

Inference:

The above table indicates that Pearson's Chi-square test value = 0.858 is greater than the significance level=0.005, so the null hypothesis is accepted.

There is no significant association between the age and the factors of influence.

7. FINDINGS AND CONCLUSION

From the study which I pursued I found out many fruitful information.

Some of the findings are mentioned below:

- There is no association between age and the level of income.
- Both the genders are paid equally with non bias responsibilities when it comes to professional side.
- When compared among the people those who belong to the science stream does not know about their investment planning.
- The friends circle influence a major portion of respondents.

- They are highly satisfied with their investment decision because of the knowledge they have over it.

- Though many wish to invest in more than one investment at a time their portfolio knowledge is probably categorized under the basic level.

- The major portion of the respondents expressed their dissatisfaction in the share market investment.

CONCLUSION

Unlike in the previous year's young people are very much interested in making investment well in advance. Most of the female respondents refused to answer the survey as they do not have the financial independence in the family circle. The basic knowledge about what an investment actually mean is lacking in certain cases. Many respondents feared investing in stock market because of its complexities. Many invest for the purpose of future safety.

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A STUDY ON INVESTMENT PATTERN OF WOMEN TEACHERS WORKING IN PRIVATE SCHOOLS

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Abstract: The research study was based on the responses of the respondent's i.e. private school teachers towards the savings and Investment pattern in Thanesar block of Kurukshetra. The aim of the study was to determine the relationship between the savings and investments preference of the private school teachers. The study was done on the different private school teachers. The data was collected by distributing a structured questionnaire to 150 private school teachers in different schools of Kurukshetra City. In spite of low income the teachers have been saving for future needs. The major impact on savings is due to the level of income of the private school teachers. The research shows that majority of the respondents are saving money as Bank deposits for the safety of future. Investment is an activity in which people with their amount of savings are involved. It is defined as the commitment of current financial resources in order to achieve higher gains in the future. The research shows that the majority of the respondents are saving money as Bank deposits for the safety of an unpredictable future.

Keywords: Annual Income, Savings, Investment, Private School Teachers.

INTRODUCTION Investment is necessary for the survival of the individual in the same way savings are necessary for unpredictable future in order to meet the emergencies in life. The main purpose of this is to ensure that money that is earned by you will not lie unproductively. It is always a better way to make money out of any extra money an individual has. Investment in various financial assets will always lead to the growth of any financial portfolio. It also helps in yielding returns which helps the individual to increase the living standard and fulfilling the daily requirements in future. Investment is also one of the excellent ways to have extra earning from the accumulated funds such as dividend from stock market, rental income from properties. An individual can also minimize their taxes through investing their money in different investment avenues. Apart from these, it also provides an individual a certain amount of extra money that gives security to the family. Different financial objectives, such as long term and short term can be achieved by planning smartly and in relevant investments. In present era there exist variety of investment avenues both traditionally existed modes of avenues or emerging investment avenues which help the people in multiplying their wealth**.**

REVIEW OF LITERATURE

1. **Neha S Shukla(2018)** focused on the analysis of investment preference of working women   It was concluded that the majority of the women preferred traditional mode of investment practices.

2. **Sood and Kaur (2017)** examined the saving and investment pattern of salaried people of Chandigarh region. The results found that majority of the teachers preferred to park their funds in fixed deposits and government securities due to lack of awareness towards other investment avenues like mutual funds

3. **Charles and Kasilingam (2016)** analyzed and examined whether emotions of individual determined their investment personality or not. The results found that intuitiveness as their emotion affects their investment personality.

4. **Thulasipriya B (2015)** conducted a study on the investment pattern of government employees. The reason behind conducted the study was to know the most preferred investment option chosen by government employee.

5. **Bhushan (2014)** examined the level of awareness and investment behavior of salaried class towards financial productsThe findings revealed that respondents were aware of traditional investment avenues and preferred to invest in safe investment options whereas awareness towards new age investment options among respondents was low.

6. **Palaniveluan d Chandrakumar (2014)** analyzed the investment choices of salaried individuals. The results showed that financial literacy played important role in deciding the various investment choices.

7. **Virani (2013)** determined the relationship between the savings and investments pattern among the school teachers. The findings revealed that because of low level of income teachers were not able to save much and therefore mainly dependent on bank deposits. **Wamae (2013)** analyzed the behavioral factors that affect the decisions of individual investors at the Nairobi Stock Exchange.

8. **Dr. Ananthapadhmanabha Achar (2012)** analyzed the saving and Investment Behavior of Teachers in Coimbatore. The results found that individual characteristics like gender of a person; his/her age and family characteristics like income of family, upbringing status were the determinants that affect the saving and investment style of individual.

9. **Bahl (2012)** analyzed the behavior of working women towards investment in Punjab region. The sample constituted 100 working women were used for the purpose of study. The findings revealed that women preferred to invest in insurance plans.

10. **Jain and Ranawat (2012)** examined the involvement of demographic variables in choosing the various investment avenues. Female investors were conservative and preferred commodities as their investment avenue. On the other hand male investors were aggressive and preferred real estate as their investment choice.

11. **Dhar and Dey (2012)** assessed the impact of psychology of an individual in their Investment decisions. The results found that optimistic individuals preferred to invest for long term than pessimistic. Males were interested in long term investment than females.

12. **Dr. S. Mathivannan and Dr. M. Selvakumar (2011)** conducted a study on saving and investment pattern of school teachers in Tamil Nadu with special reference to Sivakasi Taluk. Therefore they started preparing a budget of their anticipated expenses and comparing it with the actual expenses incurred by them. This was done in order to not indulge in any kind of wasteful expenses.

13. **Issahaku (2011)** examined the determinants that affect the saving and investment in Nadowli in Ghana. The results revealed that age does not have a major role in saving whereas other factors like level of income and occupation had.

14. **Arti, Julee, and Sunita (2011)** analyzed the differences that exist in decision making process related to investment in the different genders.Moreover due to lack of confidence in females regarding their investment decisions they were not able to satisfy them. Thus have low level of satisfaction.

15. **Mwangi, (2011)** conducted a study in order to assess the effect of behavioral factors in the decisions related to property investments in Kenya. The sample of 155 investors was taken to find the results and data was analyzed using the factor analysis. The study showed that heuristic factors played major role in influencing decisions related to investment in property.

16. **Alleyene and Broome (2010)** examined the factors that were most likely to affect the investment decision of individual investors. The study concluded attitude of an individual, the referent groups and their beliefs regarding particular opportunities significantly affect their investment decisions.

OBJECTIVES OF THE STUDY

- To analyze and examine the level of awareness towards various investment avenues.
- To analyze and examine the investment preferences of women teachers.
- To study important parameters for taking investment decision.
- To analyze Investment Motives of Respondents.

RESEARCH METHODOLOGY
RESEARCH DESIGN
Exploratory research design is used to gather preliminary information that will help define problems. Here it used to explore the investment pattern of women teachers.
SAMPLE DESIGN
For the achievement of the above stated objectives, a questionnaire is being framed with help of research papers. After that data has been collected by fulfilling of questionnaire from the women teachers who teaches students of class 11th or 12th in all the private schools of Thanesar block of Kurukshetra district of Haryana.

A. **Type of the study:** The study is descriptive in nature.
B. **Population:**

Name of District	Kurukshetra
Total no. of blocks	Thanesar, Pehowa, Shahbad, Ladwa, Babain, Ismailabad
No. of private schools in Kurukshetra	46
No. of private schools in Thanesar	20
No. of private schools with intermediate in Thanesar	15
No. of women teachers in private schools of Thanesar	826

Source: www.districtKurukshetra.in

There were 826 women teachers working in various capacities in below mention schools:-

S.No.	Names of Schools	No. of Teachers
1	Gita Niketan Awasiya Vidalya	30
2	Maharaja Aggarsain Public School	90
3	B R International School	42
4	Gyandeep Public School	20
5	D.A.V Public School	85
6	Saini Public School	50
7	Greenfield Public School	70
8	Pooja Modern School	32
9	Maharana Pratap Public School	60
10	Mahavir Jain Public School	50
11	Seth Teckchand Memorial Public School	47
12	Maharishi Vidya Mandir	55
13	Wisdom Public School	70
14	Millennium School	65
15	Gurukul Sr. Secondary School	95
	Total	**826**

Source: schools websites

My present study has done specially of those women teachers who are teaching higher secondary.

C. **Sampling procedure:**
   The data has been collected through direct questionnaire method and the questionnaire is getting fulfilled by meeting teachers personally by going to the schools.

D. **Sampling unit:**
   Women teachers teaching in private schools of Thanesar block of Kurukshetra.

E. **Sample size:**

Name of block	Thanesar
No. of private schools with intermediate	15
No. of women teachers teaching higher secondary	150

Source: www.districtKurukshetra.in

F. **Methods of data collection:**
Both the Primary and Secondary sources of data will be used. Mainly the research is based on Primary data. For Primary data of research a questionnaire is framed for the collection of primary data whereas secondary source will include data given in the Government Reports related to relevant information. Apart from it, the secondary sources will include journals and research publications.

LIMITATIONS OF THE STUDY

- The study is limited only to the private schools of Thanesar block of Kurukshetra.
- Since it is a sample based study so the awareness and investment preferences of one fifty respondents is assessed only, so the findings may not be generalized to entire population.
- Unavailability of teachers due to working schedule.

Data Analysis and Interpretation

Frequency distribution and pie chart are the tools that are used to analyze the data collected along with the help of tabular and graphical presentation.

- **What is your Length of Service?**

Figure 1 Respondent's Length of Service
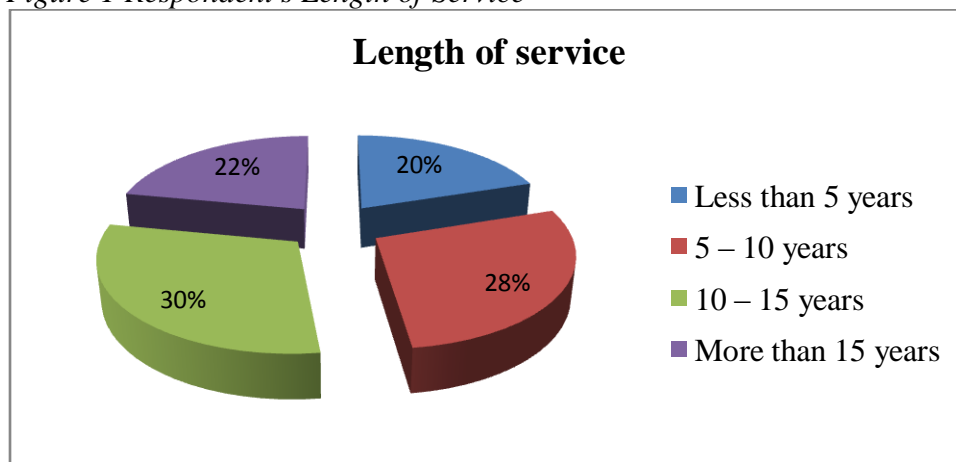
- **What is your Income Level?**

Figure 4 Respondent's Income Level

Monthly income (Rs.)

- Less than Rs.20,000
- Rs.20,000 to Rs.30,000
- Rs.30, 000 to Rs.40, 000
- above Rs.40, 000
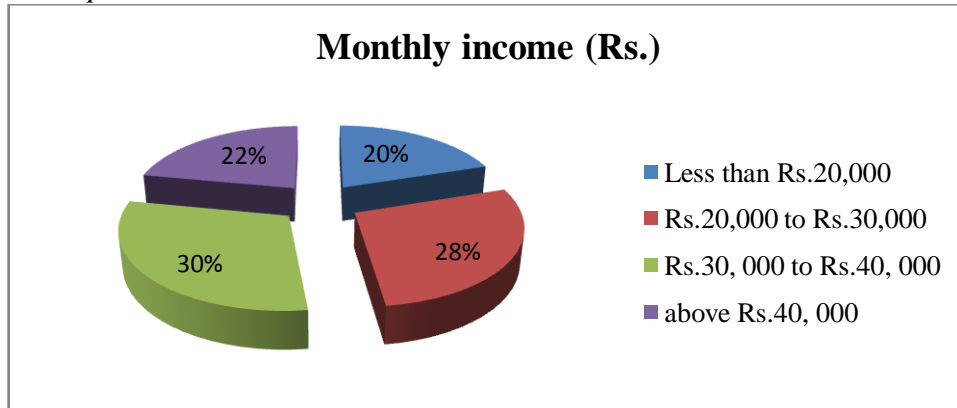
Source: primary data

- **What is your Annual Investment?**

Figure 5 Respondent's Annual Investment

Annual investment (in lakhs)

- Less than 1 lakh
- 1lakh to 3 lakhs
- 3 lakhs to 5 lakhs
- more than 5 lakhs
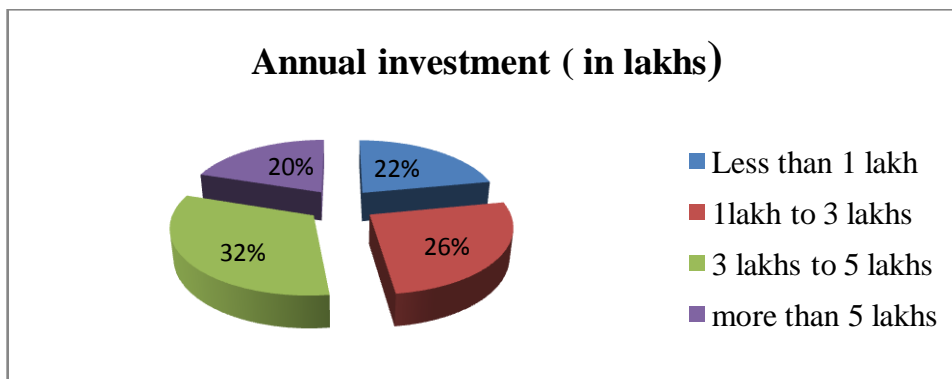
Source: primary data

- **Are you aware about traditional investment avenues(fixed deposits, small saving account, gold and silver, insurance schemes, mutual fund,stocks,debt securities,real estate)?**

Table 6Awareness about traditional Investment avenues:

Awareness about debt securities	Frequency	Percentage
Aware	150	100
Unaware	0	0
Total	150	100

Source: primary data

- **Are you aware about emerging investment avenues(hedge funds,derivatives,venture capital,collectible items,private equity)?**

Figure 7Awareness about emerging investment avenues
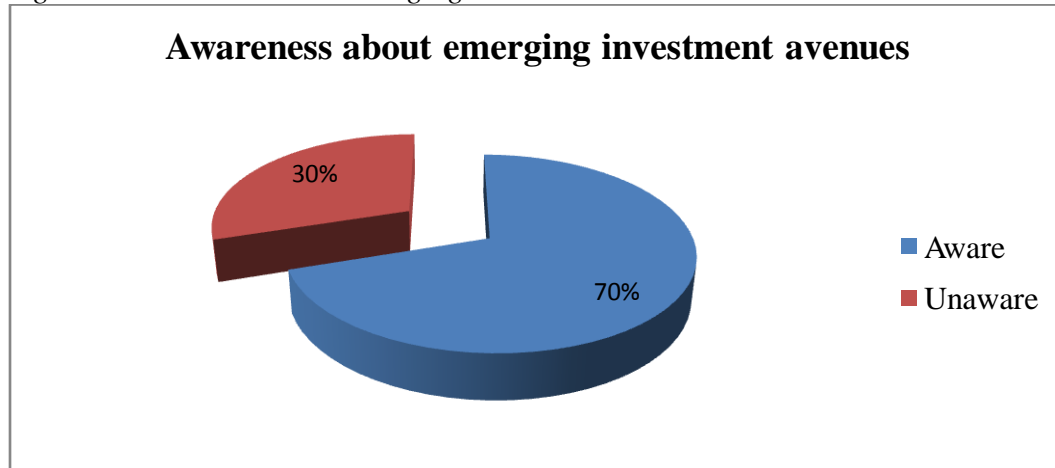
Source: primary data

- **What are your sources of information about investment avenues?**
  (A) family members and colleagues   (B) journal and magzines
  (C) TV and Radio   (D) Agents and Advisors
  (E) Online research   (F)All of the above

Figure8 Sources giving information about Investment Avenues
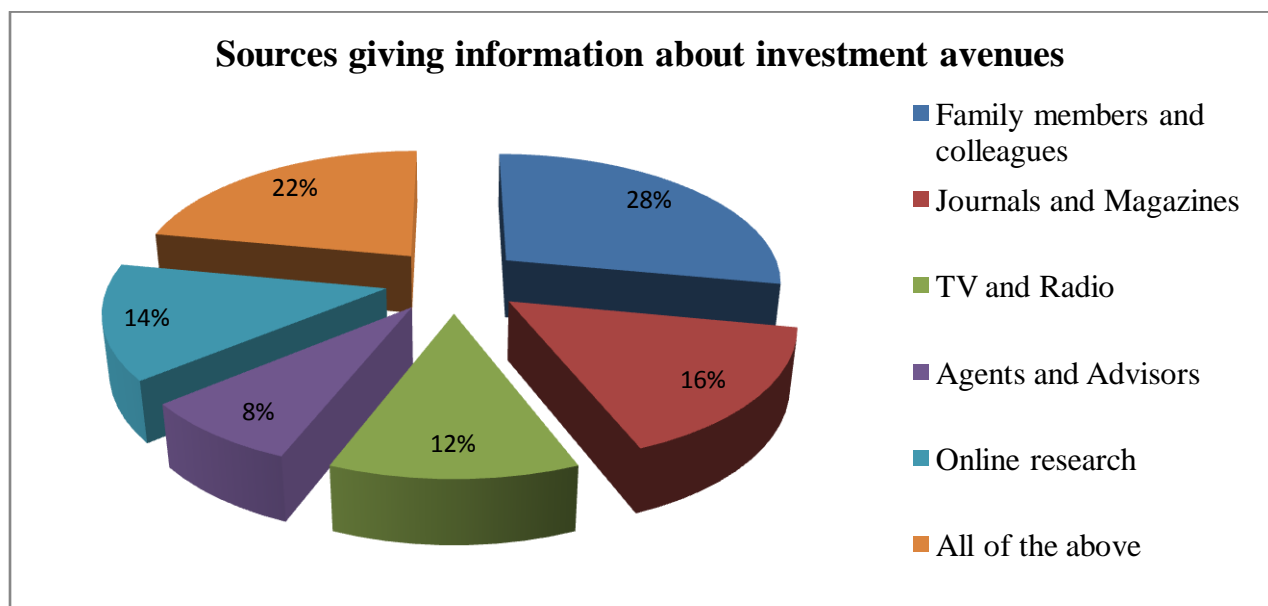
Source: primary data

- **What is your suggestions to create awareness among working women about various investment avenues?**

Figure 9 Suggestions to create awareness among Working Women about various Investment Avenues
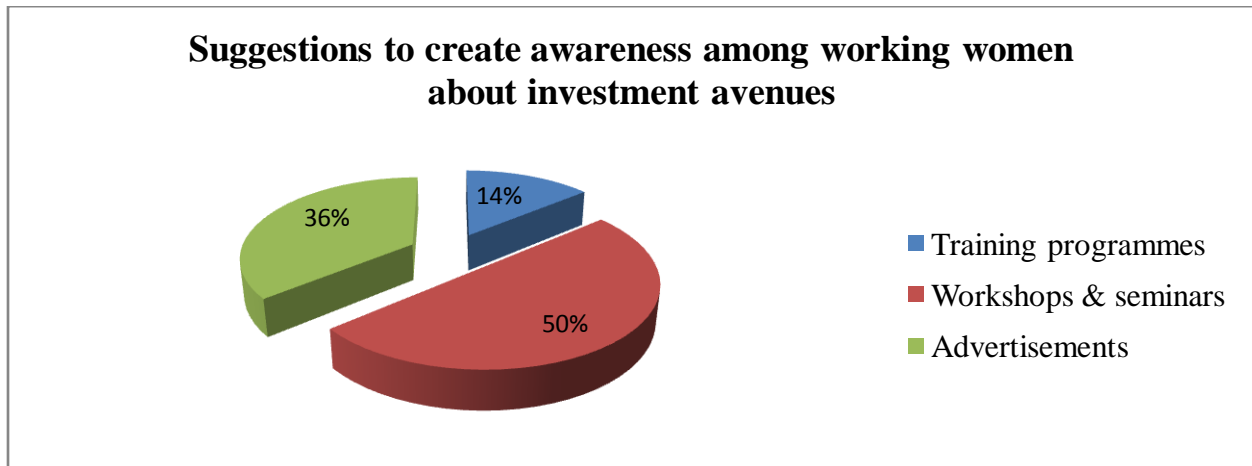
Source: primary data

- **What are your investment preferences amongst the following?**

(A) Fixed Deposits   (B) Small saving schemes   (C) Gold and silver

(D) Insurance schemes   (E) Mutual funds   (F)Stocks

(G)Debt securities   (H) Real estate   (I) Hedge Funds

(J)Derivatives   (K)Private Equity   (L)Venture Capital

(M) Collectible Items

Table 10 Investment Preferences of Respondents

Investment preferences	Ranks	Frequency	Percentage
Fixed Deposits	1	27	18
Small saving schemes	2	21	14
Gold and Silver	3	18	12
Insurance schemes	4	16	10.67
Mutual Funds	5	14	9.33

Stocks	6	12	8
Debt securities (Bonds etc)	7	10	6.67
Real Estate	8	9	6
Hedge Funds	9	7	4.67
Derivatives	10	6	4
Private Equity	11	5	3.33
Venture Capital	12	3	2
Collectible Items (stamps and art works)	13	2	1.33
Total		**150**	**100**

Source: primary data

Figure 10 Investment Preferences of Respondents
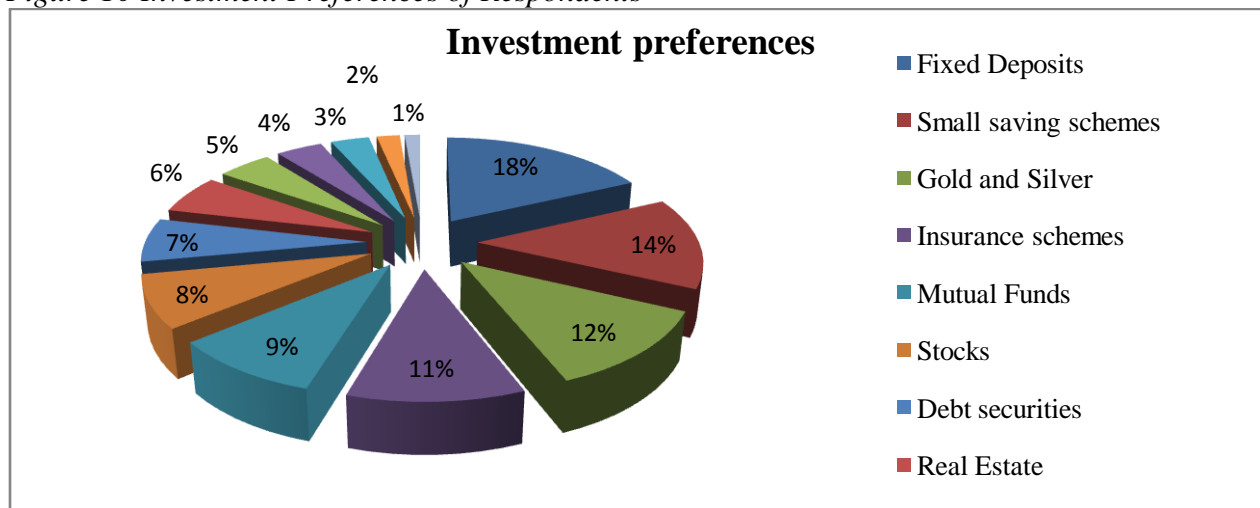
Source: primary data

- **What is your Preference towards Women specific Investment plans in both Private and Public sectors?**

Figure 11 Preferences towards Women specific Investment plans both Private and Public sectors

Preferences towards womenspecific investment plans in both private and public sectors
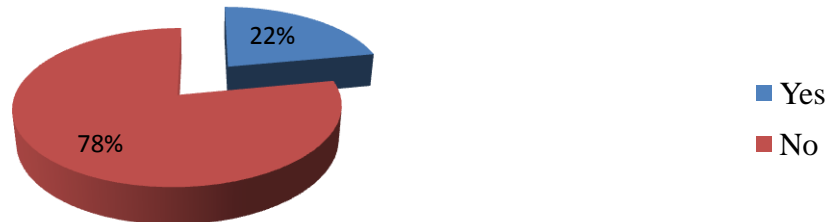
Source: primary data

What are your Investment Motives

Table 12 Investment Motives of Respondents

Investment motives	Ranks	Frequency	Percentage
Safety	1	36	24
Capital appreciation	2	27	18
Return	3	21	14
Liquidity	4	18	12
Convenient to operate	5	15	10
Tax savings	6	12	8
Regular income	7	9	6
Less transaction cost	8	6	4
Savings for old age	9	4	2.67
Prestige	10	2	1.33
Total		150	100

Source: primary data

- **What is your Time Horizon of Investments?**

Figure 13 Time Horizon of Investments

Time horizon of investments

- Long term(greater than 3 years) — 50%
- Medium term (1 to 3 year) — 38%
- Short term (less than 1 year) — 12%
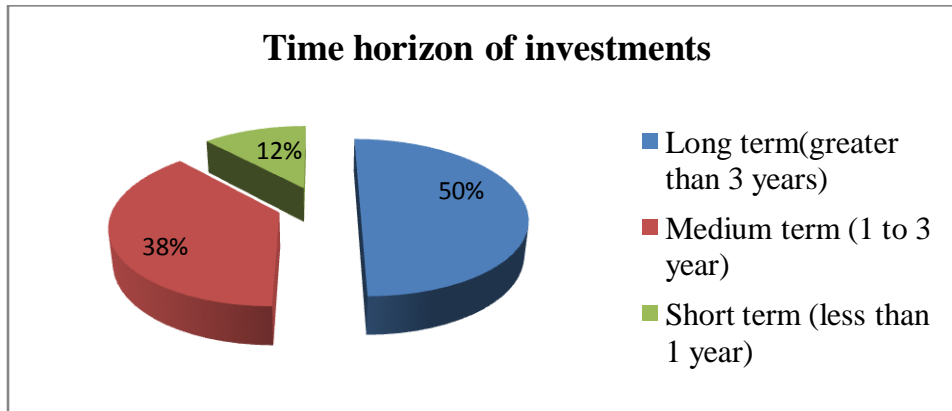
Source: primary data

What is your Sources of Investment?

Table 14 Sources of Investment

Source of investment	Frequency	Percentage
Own savings	105	70
Borrowings	30	20
Both	15	10
Total	**150**	**100**

Source: primary data

Figure 14 Sources of Investment

Source of investment

- Own savings — 70%
- Borrowings — 20%
- Both — 10%
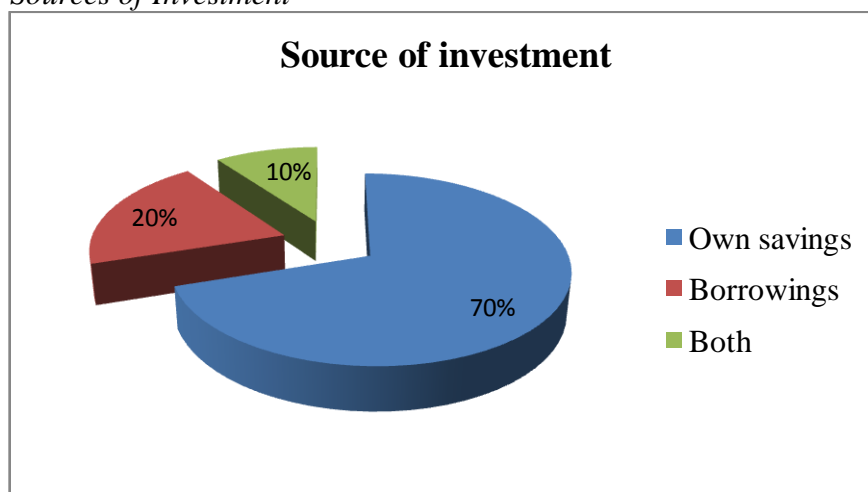
Source: primary data

- **What is your Expected Rate of Return on Investment?**

Table 15 Expected Rate of Return on Investment

Expected rate of return on investment	Frequency	Percentage
Less than 10%	45	30
Above 10%	105	70
Total	150	100

Source: primary data

Figure 15 Expected Rate of Return on Investment
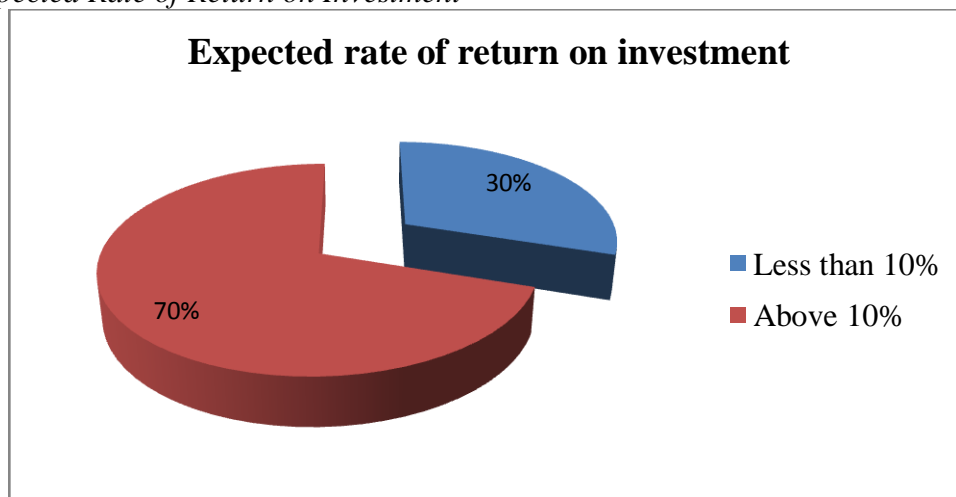
Source: primary data

- **What is your Received Rate of Return on Investment?**

Table 16 Received Rate of Return on Investment

Received rate of return on investment	Frequency	Percentage
Less than 10%	105	70
Above 10%	45	30
Total	150	100

Source: primary data

Figure 16 Received Rate of Return on Investment
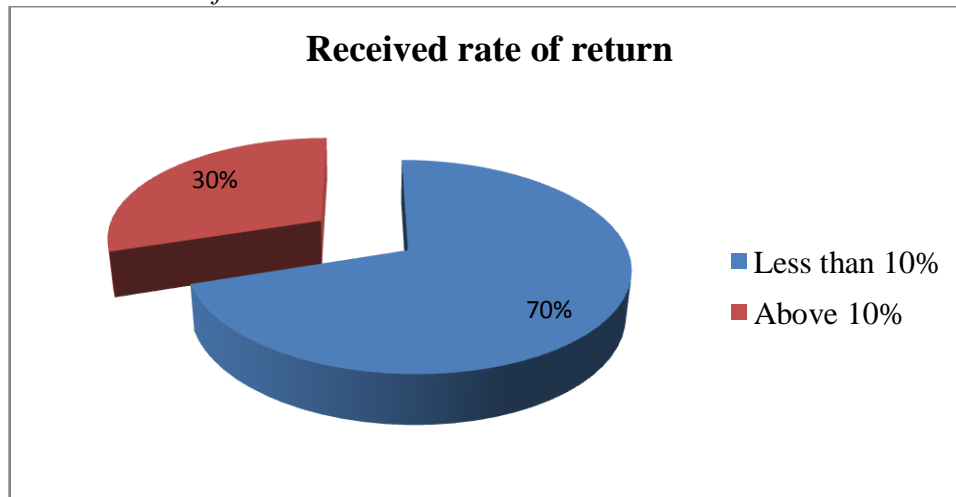
Source: primary data

- **When you monitor your investment?**

Table 18 Monitoring of Investment

Monitoring of investment	Frequency	Percentage
Daily	6	4
Weekly	21	14
Monthly	45	30
Occasionally	78	52
Total	150	100

Source: primary data

Figure 18 Monitoring of Investment
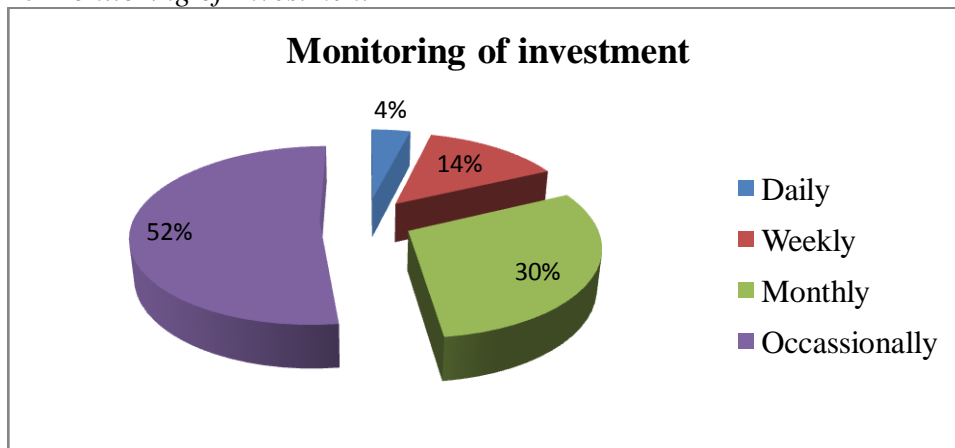
Source: primary data

- **What is your preferred sector of investment?**

Table 19 Respondent's sector Preference for Investment

Sector preference for investment	Frequency	Percentage
Private sector	33	22
Government sector	117	78
Total	150	100

Source: primary data

Figure 19 Resondent's sector Preference for Investment
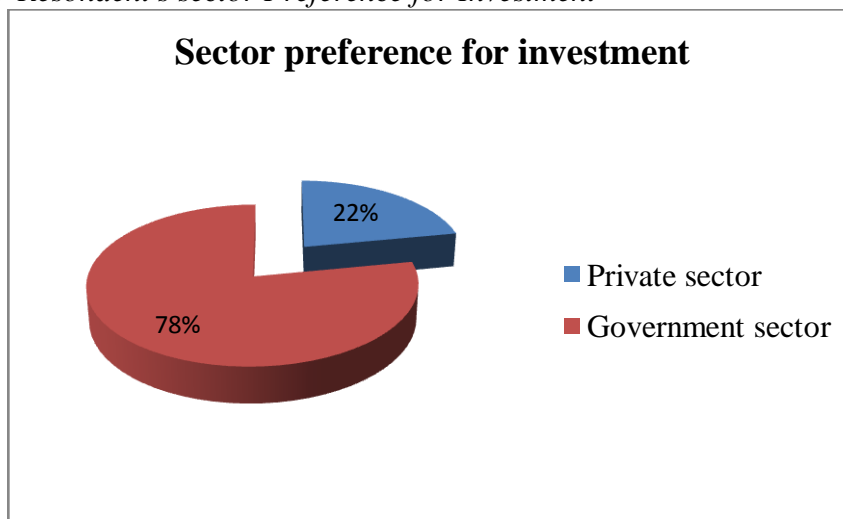
Source: primary data

FINDINGS OF THE STUDY

- As per the analysis, it has been found that majority of the respondents are aware of traditional investment avenues including debt securities, stocks, real estate, gold and silver, fixed deposits ,mutual funds, small saving schemes and insurance policies.
- The findings indicate that most of the respondents are aware of emerging investment avenues including hedge funds, private equity, venture capital, derivatives and collectible items but not having detailed knowledge of these investment avenues.
- Majority of the respondents is aware of women specific investment plans in both private and public sector.
- Major part of the respondents prefer to invest their money in fixed deposits and small saving schemes which is traditional investment avenues. This respondents till now not prefer to invest in emerging investment avenues.
- The study reveals respondents main motive behind their investment is safety which constitute 24% of the total sample followed by 18% who give priority to capital appreciation as their motive behind investing the money.

- As per the analysis, it has been found that most of women teachers prefers to invest their money in government sector.

CONCLUSION

From the above study, it can be observed that money is very much important for every individual. They know the money's worth and realized that it is very important to invest in the right avenue in order to meet their future requirements. As future is very unpredictable, therefore it is necessary to channelize your funds and energy in right direction. However study also revealed that women teachers are well aware of the traditional avenues that exist for the investment and also have detailed knowledge of the most of the available traditional investment choices. However they are fully confident to park their funds in fixed deposits, small saving schemes, bullions and insurance. The idea behind this the safety and security these options provide in terms of the principle amount as well as extra income in terms of interests, but it has also been observed that stock market options like shares and debentures, mutual funds are still there in which women teachers would not feel confident to invest their money.

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A CASE STUDY ON DELAY IN CONSTRUCTION PROJECTS

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Abstract

The construction industry in Kashmir is an important sector due to its enormous contribution to the state's economic development. This in terms of employment opportunities and attraction of foreign direct investments which grossly contributes to the states GDP. However due to the geographical, political, social and financial situation of the state, many construction projects are prone to delay. These delay factors can only be avoided by first identifying the factors and their sources. The main aim of this research was to find out the main causes of delay in Building construction projects in Kashmir. The research design was quantitative, where the data was collected from clients, consultants and contractors using questionnaires. The questionnaire had a list of delay causing factors of which the respondents were ask to rank each according to the 5-point Likert scale. The data obtained were analyzed using the Statistical Program for Social Scientists (SPSS). The results obtained indicate that the top major causes of delay were; fluctuation of prices of construction materials, shortage of materials, inaccurate time estimation, and errors during construction. In addition, the top major effects of delay were; Cost overruns, acceleration of losses, time overrun, negative social impacts and litigation. Also, the top major risks associated with construction delay were; too much pressure on project stake holders, price inflation of materials and overall project, disputes amongst project participants, project abandonment, overall cost increase and decline in revenue. And finally, the top major delay mitigating measures were; Information sharing, Total Quality Management (TQC), Quality cycles, Benchmarking, and Joint risk management.

Keywords: Construction delay, delay mitigation, risks, consultants, clients and contractors

1. Introduction

Construction can be defined as an activity of the physical creation of infrastructure, superstructure and related facilities. It therefore comprises all civil engineering works and all types of building projects including; housing as well as maintenance and repair of existing structures (wells, 1984). Another definition states construction is a broad process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and beneficiation of raw materials, the manufacturing

of construction materials and components, and the construction of the project cycle from feasibility to deconstruction and the management and operation of the built environment (Plescis 2002).A broad definition of term stipulated that construction is that sector of an economy which through planning, design construction, maintenance, repairs and operation, transforms various resources into constructed facilities. The types of public facilities produced range from residential and non-residential to heavy constructions (Moavenzadeh, 1978).

Finally, according to (Ofori, 1990) construction is that sector of an economy which plans, designs, constructs, alters, maintains and eventually demolishes buildings of all kinds of civil engineering works, mechanical work, electrical engineering structures and other similar works. He further describes the construction industry as having different sectors producing heterogeneous products which are immobile, complex, durable and costly. Construction delay can be referred to as a prolonged construction period beyond that which was estimated previously. These delays have been proven to be a potential source of risks in the construction industry such that many current studies are looking for ways it can be managed. The various risks associated with projects delay are cost related where delay will generally lead to an overall increase in the cost of the project. Various studies carried out by (Cohen and Palmer, 2004, Baloi and Price, 2003, Milner and Lessard, 2001) have found sources of and categories of construction risks that needs to be managed as part of the project management process. Delays are at integral part of modern construction processes (Yates and Epstein, 2006). They stated that project delay starts from the inception phase of the project itself. In addition (Scott et al, 2004) mentioned that there is a tendency for construction projects to suffer from delays and such delays poses potential loses for all stake holders. These include client or owner through loss of use and increase cost and for contractor and consultant through prolong presence on the site and loss of confidence.

Delay is mostly common in the traditional type of contracts in which the contract is awarded to the lowest bidder. This procurement method is mostly practiced in developing countries. Ensuring that the project is delivered on time is one of the most significant needs of the clients in construction industry (Latham, 1994). Moreover, completion of projects within the estimated time is an indicator of how efficient the construction industry is (Nedo, 1988). Quality, time and Cost are of primary concern to the contractor, but most often construction projects are procured based on only two factors; time and cost (Bennette and Grice, 1990).

1.2 Characteristics of construction

The following are common features of construction; immobility, uniqueness, heaviness, bulkiness, complexity, long duration of process, high expenses and durability (Turin, 1980). It was also pointed by (Moavenzadeh, 1978) that construction is often characterized by immobility, custom built nature, high initial expenses, complexity, continuous changing technology. Thus, the features of construction products and the broad range activities in the construction industry make construction worth of different consideration. The construction industry must satisfy the demand for housing, building constructions such as; social and commercial buildings, heavy engineering constructions and industrial constructions including factories (Palani, 2000).

1.3 Objectives of the study

The main objective of this research is to find out the causes of delay in building construction projects in Kashmir's construction industry, further other objectives of the study are;

1. To find out the factors that causes construction projects delay

2. To investigate the effects of construction projects delay.

3. To determine the risks associated with construction projects delay

4. To identify the relevant ways of eliminating or mitigating the delays of construction.

2. Methodology

This chapter comprises of the method and the design that was used to conduct the research. It was a quantitative research in which the data was collected using questionnaires. The population was made of clients, contractors and consultants who were selected by random sampling and convenience sampling technique. There was collection of both primary and secondary data. The primary data was obtained using questionnaires while the secondary data was gathered from the literature. The questionnaire design, the different sections of the questionnaires, the scale as well as the pilot study was conducted to ascertain the reliability of the questionnaire.

The research methodology chosen for this study comprised of intensive literature review, mail questionnaire to building construction stake holders in Kashmir and a statistical analysis of the Survey.

1. Literature gathering
2. Literature review
3. Identification of delay factors, effects, risks associated with delays and mitigation measures.
4. Questionnaire preparation
5. Questionnaire Survey
6. Data collection
7. Data analysis

2.1 Research Design

The research was designed to get opinions from clients, consultants and contractors of construction companies in regards to the factors causing delays, effects of delays, as well risks associated with construction delays. The possible causes, effects and risks of delays were identified from the literature and these factors were tested with the stakeholders of the Kashmir's construction industry.A total of 30 delay factors were identified from the literature and stake holders of the Kashmir construction industry were asked to give their opinion on these causes in the form of ranking.Also 11 effects of construction projects delay were also identified from the literature and questions were designed according to these factors to get the opinion from stake holders of

Kashmir's construction industry. Similarly, risks factors associated with construction projects delays were also identified.

2.2 Population and Population size

The population was made of consultants, contractors with over 10years of experience in the construction industry and private clients or owners. Moreover all respondents had attained tertiary education. This implied the high position, lengthy years of work experience and educational background provided our respondents with enough knowledge of the construction industry with issues relating to causes, effects and risks of construction delay.

The population size consisted of 50 respondents, which included 20 contractors, 15 consultants, and 15 clients. The population size was limited to this number to effectively maximize the time and cost allocated for the research since the questionnaires had many questions and will be time consuming which might discourage some respondents from participating. Also the wide nature of the questionnaire may not be within the competence of some construction stakeholders. However effective selection of the target respondents with high competence and experience proved to shield these weaknesses.

2.3 Sampling Techniques

In this study, we used two sampling techniques because of the quantitative nature of the research. We obtained a list of consultants and contractors with their head offices in Srinagar from websites. A random sampling method was then used to select the contractors and consultants. Random sampling is defined as the probability of choosing people or things in a random manner, without any criteria with the aim of eliminating bias (Komb and Tromp, 2006). A total of 35 construction companies were selected from the list of local and domestic registered companies based in Srinagar from where 15 consultants and 20 contractors were randomly selected. The private clients or owners were selected using the convenience or the snow ball sampling technique. Snow ball sampling is a non-probability technique where elements are selected based on the researcher's convenience that is from friends, colleagues, professional contacts or referral networks. This method is highly recommended in a situation where there is difficult to obtain data from random sampling.

2.4 Data Collection

This is referred to as the gathering or the collection of information from customized target respondents to suitably answer the research questions or the research objectives or give answers to findings. In this study, the data was obtained using 2 different methods.

2.5 Primary data collection

The primary data refers the first-hand information obtained by the researcher himself in his or her study. This information is made available for the first time only by the researcher. The information can be collected through direct personal investigations, through respondents, and survey using questionnaires. The collection modes could also be through; emails, personal interview, phone

interview and self-administered survey. The advantages of this method of data collection include; reliability and accuracy and moreover it is a better method for intensive investigation. On the other hand, the disadvantages will be high cost and too much time spent, and the method is not suitable for extensive enquiry.

Because of the quantitative nature of our study, the primary data was collected in the survey by making use of questionnaires and also telephone interviews. The questionnaires were emailed to our target respondents who were expected to fill the soft copy of the questionnaires and returned them by emails.

2.6 Secondary data collection

The secondary data refers to that information which have already been collected, analyzed, documented and published by some other researchers or people. The researcher therefore uses this information to support his or her current study or findings. Obtaining this information is faster, less expensive, and vigorous activities such as surveys are not required. However, this information collected is not always available for free and will cost money, the information is not always enough, some are old or expired meanwhile some are false information.

In this study, our secondary data was collected from academic online websites such as Emerald, online journals, School libraries and both published and unpublished articles.

2.7 Questionnaires

In order to determine the perception of different stake holders in Kashmir construction industry regarding factors causing delays, a questionnaire was developed. This was the main tool used to collect the data from our target respondents. The questionnaire was structured into 5 sections to meet all 4 research objectives.

Section A had questions to determine the respondents' background

Section B was to design to get the opinions of construction stake holders regarding causes of construction delay.

Section C questions were design to ascertain the effects of delay.

Section D questions were to bring out risks associated with construction delays. Section was design to determine the measures to mitigate risks of construction delays

The questionnaire had a total of 64 questions. 30 questions were related to the causes of construction delays, 11 questions were related to the effects and the rest of the questions were related to risks associated with delays and measures of mitigating the risks.

For the factors causing delays and the effects of delay, the questions were design based on the 5-point Likert Scale which measures from 1-5 according to the level of contribution and impact of each factor.

Strongly Agree   (5)

Agree   (4)

Moderate   (3)

Disagree   (2)

Strongly Disagree   (1)

For questions relating to mitigating risks due to construction delays, a total measure were identified from the literature and the questionnaires were design using the 5-point Likert scale to determine the effectiveness of each of these measures.

Very highly effective   (5)

 Highly effective   (4)

Effective (3)

Lowly effective (2)

Very lowly effective   (1)

2.8 Pilot study

A pilot study involves testing a questionnaire with a small group of people who represents target respondents. This will help pin point mistakes in the questionnaire and will also determine if the questions will be understood and easily answered by the respondents.

A pilot study was conducted in Malaysia. We had the opportunity to meet some contractors and consultants around Petaling Jaya, the sections in the questionnaires should contain general information about the respondents.

1.   The questionnaires must have cove page

2.   The sections in the questionnaires should contain general information about the respondents.

3.   Some questions needed to be modified including more details

4.   Some questions were repeated having the same meaning

5.   Use simple words to ease understanding of the questions.

The feedbacks back were then noted and the questionnaires modified and adjusted accordingly. A total of 50 questionnaires were prepared and sent via emails to consultants, contractors and private clients in Kashmir. Telephone interviews were also conducted with some contractors and consultants to get their opinions on mitigating construction risks associated with delays. Out of

the 50 questionnaires, 15 were sent to contractors, 15 to consultants and 20 private clients. All questionnaires were returned via emails after 3weeks.The results were then obtained and analyzed using statistical tools.

2.9 Interpretation

Based on the study design, the questionnaires were sent to the respondents only through emails and there was no physical contact with them. Follow up was done via phone calls to constantly remind them on the importance to participate in the survey and also crucial nature of the time line to resend the questionnaires. Only questionnaires that were fully completed were accepted. Those partially filled were not considered for the analysis However, the numbers of questionnaires successfully completed were enough to produce valid and justifiable results.

3.Data analysis

A series of statistical tests and analysis were carried out for the factors of each of the section. These include the causes of delay, effects of delay, the risks of delay as well as ways of mitigating delays. Results of the questionnaires which were carried out using the SPSS. The results were represented using tables and descriptive statistics such as the bar charts, pie charts, and the mean. The Cronbach Alpha test that's showed the validity of the questionnaire.

3.1 Cronbach Alpha

Before the results obtained from the questionnaires received were being analyzed, a Cronbach analysis was carry out to ascertain the reliability of the questions. The results were represented on the table below

Table (1.1) shows the Cronbach's Alpha reliability test

SECTIONS	Cronbach's Alpha	Number of Questions
B	0.996	30
C	0.981	11
D	0.978	10
E	0.989	13

3.1.1 Interpretation

The results from the Cronbach analysis indicate that all the items for the sections are correlated. There is internal consistency and the items functions as group for each section. This is because the Cronbach Alpha coefficient for each group of questions is high and close to 1. For Section B 0.996, section C 0.981, section D 0.978 and section E 0.989. Therefore, we concluded that our test and questions were reliable.

3.2 Participants job position
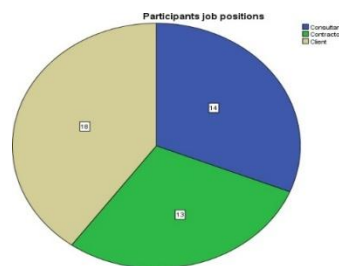
Figure 1 participants job positions

The results indicate that out of 50 questionnaires that were distributed, 45 were successfully completed and returned. Of the 45 questionnaires returned, 18 (36%) were answered by Clients, 14 (28%) were responded to by Consultants and 13 (26%) were answered by Contractors.

3.3 Factors causing Construction delay.

To analyze the results of the factors causing delay, SPSS was used to calculate the mean of distribution of each factor. This was summarized as follows on **the table (1.2)** below.
Table 1.2 summarize of the 30 factors

Clients	Consultants	Contractors
Fluctuation of prices	Inaccurate time estimation	Errors during construction
Shortage of materials	Improper planning	Old technology
Delays in payment to Contractors	Design changes	Late delivery of material
Compensation issues	Inaccurate cost estimation	Incompetent contractors
Funding problems	Project schedule changes	Inadequate contractor's Experience
Late delivery of material	Supply/procurement Problems	Incompetent project team
Contractual claims	Poor understanding of the Project	Accidents during construction
Government interference	Acts of God	Multiple projects by contractors
		Inappropriate construction Methods

3.4 Kruskal Wallis H Test
The Kruska Wallis test was carried using SPSS to determine if there are significant differences between the delay factors caused by clients, contractors and consultants. The results were reported as shown on the table below.

Table 1.3 Kruskal Wallis H Test

Ranks

	Project participants	N	Mean Rank
delay factors Clients		8	8.50
Consultants		8	8.50
Contractors		14	23.50
Total		30	

3.4.1 Interpretations

The results of the Kruska Wallis H test indicate that there was a statistical significant difference in the delay factors between the different groups of the project participants, x^2

(2) = 29.000, p = 0.014, with the mean rank for each project stakeholder group being Clients (8.50), Consultants (8.50) and Contractors (23.50).

3.4.2 Causes of Construction delay due to Clients

The table below shows the different factors causing construction delay. The factors were ranked according to their mean scores from highest to smallest. The factor with the highest mean score is the most common delay factor caused by clients.

Table 1.4 The Mean Score Value and Ranking

Clients	Mean score	Rank
Fluctuation of prices	4.0000	1
Shortage of materials	3.6667	2
Delays in payment to contractors	3.4667	3
Compensation issues	3.4222	4
Funding problems	3.3778	5
Late delivery of material	3.3111	6
Contractual claims	3.2889	7
Government interference	3.1333	8

3.4.3 Causes of construction delay due to Consultants

Table 1.5 The Mean Score Value and Ranking

Consultants	Mean score	Rank
Inaccurate time estimation	3.6444	1
Improper planning	3.5600	2
Design changes	3.4000	3
Inaccurate cost estimation	3.4000	3
Project schedule changes	3.2444	4
Acts of God	3.0000	5
Supply / procurement problems	2.8889	6
Poor understanding of the project	2.8889	6

3.4.4 Causes of construction delay caused by contractors

Table 1.6 the Mean Score Value and Ranking

Contractors	Mean score	Rank
Errors during construction	3.5556	1
Old technology	3.3111	2
Late delivery of material	3.3111	2
Skills shortage / unavailability	3.2889	3
Incompetent contractors	3.2222	4
Inadequate contractor's experience	3.2222	4
Incompetent project team	3.2222	4
Accidents during construction	3.2000	5
Multiple projects by contractors	3.2000	5
Inappropriate construction methods	3.1800	6
Conflicts among the involved parties	3.1333	7
Poor site management	3.0200	8
Delays caused by subcontractors	2.9800	9
Rework due to errors.	2.8222	10

3.4.5 Interpretations

1. Acceleration of losses
   In terms of increase cost and not being able to meet with its customers demand. When construction projects are delayed, the organization losses a lot of money and time

2. Cost overruns
   This is one of the most common effects of construction delays. Delay in construction might lead to an increase in price of construction materials as well as price of labor.

3. Time overruns
   Delay will cause the project to fall behind schedule. This is detrimental to the owner because he might not be able to meet up with his objectives on time.

4. Disputes
   Conflict will arise amongst project participants as to who will bear the responsibilities as a result of the delay.

5. Negative social impact
   Delay in many community construction projects will have negative effects on the social structure such as riots strikes and boycott.

6. Bankruptcy
   When construction projects are delayed possibly due to finance, the organization will utilize most of its assets in order to complete the projects. If the delay persists, in attempt to finish the project, the company may run out of cash.

7. Litigation
   If there is no agreement amongst the project participants as to who will bear the responsibilities of the project delay, either of them may file a law suit against each other.

8. Total Abandonment
    Prolong project delay might lead to abandonment by the owner or contractor. This may be

    due to inadequate finance or expertise to successfully complete the project.

3.5 Mitigating Risks of Construction Delays

The data obtained from respondents were analyzed using SPSS by computing the mean score for each factor according to the respondent's responses. The mean scores were ranked from the highest to the lowest and represented on a statistical table. The risk mitigating factor that scored the highest mean was considered to be a very highly effective means of eliminating risks associated with construction delay in the Kashmir's construction industry.

3.5.1 Kruskal Wallis H Test.

The Kruska Wallis test was carried using SPSS to determine if there are significant differences between the delay factors caused by clients, contractors and consultants. The results were reported as shown on the table (4.19) below.

Table 1.7 Differences between the delay factors caused by clients, contractors and consultants

	Project participants	N	Mean Rank
Delay mitigation	Clients	18	15.53
	Consultants	14	24.17
	Contractors	13	20.42
	Total	45	

3.5.1.2 Interpretation

1. Information sharing

This involves exchange of information amongst the project stakeholders throughout the course of the project construction. This will play a very important role in minimizing the delay factors.

2. Total Quality Management

The organization's management including the project stakeholders to always strive to provide for their customers and clients the best quality products within the allocated time will greatly reduce the chances of delay.

3. Quality cycle

A group of employees in the project construction team should be designated to occasionally meet and discuss about quality throughout the construction phase.

4. Benchmarking

Information from already completed or ongoing projects should be used to compare the performance of the construction project in question.

5. Joint Risk management

All the project stakeholders should collaborate in sharing and solving of the risks that are involved throughout the project construction phase. This will enable a better understanding of the risks of delay and appropriate measures put in place to tackle them.

6. Continuous training

Training in both onsite and offsite should be a continuous process in the project construction. This will add up to the employees' efficiency to perform their tasks within the shortest time possible without a fall in the quality of the job done.

7. Automated material tracking.

Regular monitoring of the construction materials will easily signal when there is shortage. Thus, this will reduce the risks of delay due to material shortages.

8.Cross firm incentive system.

The incentive system should cut across all members of the organization and should be similar to what other firms are giving to their employees. With this system the employees will feel motivated to perform their tasks effectively.

3.6 Discussion

Based on our research in the Kashmir's building construction industry, we discovered the top 10 most common causes of delay. These were; fluctuation of prices of construction materials, shortage of materials, inaccurate time estimation, errors during construction, improper planning, delay in payment to contractors, compensation issues, design changes and inaccurate cost estimation. It is observed that majority of the delay factors are Contractor and Consultant related, while the client also plays a role in the delay in terms of compensation issues and design changes and delay in payment of contractors.The 5 top most common effects were; Cost overrun, acceleration of losses, time overrun, negative social impacts and litigation.

Conclusion

Just like any other construction industries, the Kashmir construction industry is also prone and liable to delay. But however, the factors that causes delay in construction industry varies across different countries based on the political and socio-economic condition of a particular state. The consequences of building construction projects are always negative thus delay should be avoided at all cost. To avoid construction delays, it is imperative for project participants to first of all identify the possible factors that can cause delay and label them as critical success factors. Once these factors have been identified, suitable preemptive measures can also be put in place to counter the negative effects that may arise as a result of their occurrence.

The already identified delay factors can then be traced to their possible causes that are due to either contractor, consultants, clients, environmental, government or others. With all this resolution method put in place it will be very easier to identify whoever is at default. Kashmir is an underdeveloped state lacking all the resources needed to successfully complete a building construction project within the allocated time and budget. This has had adverse effects on infrastructural development aspect of the economy and also its construction industry reputation in the global market. Therefore, it is not doubtful that the government and private institution keep spending huge amount of money on construction projects which are later delayed and some abandoned. From our findings, we conveniently pointed out that the most common causes of construction project delays were, fluctuation of prices of construction materials, shortage of materials, inaccurate time estimation, errors during construction, improper planning, delay in payment to contractors, compensation issues, design changes and inaccurate cost estimation. In addition, the most common effects of construction delays were proven to be; Cost overrun, acceleration of losses, time overrun, negative social impacts and litigation. Meanwhile the most common risks associated with construction delay were; too much pressure on project stake holders, price inflation of materials and overall project, disputes amongst project participants, project abandonment, overall cost increase and decline in revenue. And finally, the most effective measures of eliminating delays in construction were; Information sharing, Total Quality Management (TQC), Quality cycles, Benchmarking, Joint risk management, continuous trainings, automated material tracking and early involvement of contractor and subcontractors.From the survey conducted and analysis, it was discovered that most of the factors causing delay in the Kashmir's construction industry are due to the clients. Most of the factors were financial related because of the economic situation of the state. The next stakeholder responsible for causing delay is the contractor due to inadequate skills.Moreover, in terms of risks that arise as a result of delay, the client again carries the highest risk because he is the investor followed by the contractor who executes the project. The consultant on the other hand has very little or no risk associated with delays.

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Variation in Properties of cement mortar using different binding agents.

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Abstract

Mortars are typically made from a mixture of sand, a binder such as cement or lime, and water. While the sand and the water can be easily found in nature, cement needs special processing plants to be produced. The production of cement alone has increased dramatically over the past 80 years due to a continuous increase in demand for concrete. Taking into account that the cement content in normal strength concrete ranges from 10% to 15% and that the concrete industry is the largest consumer of natural resources in the world, one could only imagine the environmental burden it creates. This project brings its contribution to the investigation concerning the use of a new binders, in the form of glass dust or brick dust as partial or total replacement of the ordinary Portland cement in mortar/concrete. Glass is a material with a high percentage of amorphous silica, favouring pozzolanic reactivity. Existing bricks contain embodied energy. When the bricks are no longer needed for whatever purpose they were created, their useful life can be extended by repurposing them in pozzolanic mortars. Even Clay content present in the kiln bricks exhibits pozzolanic activity if it is used in high strength Portland cement. The properties of mortar containing the above binders are investigated. The setting time, compressive strength of the mortar will be determined thus giving an idea about change in the various important characteristics of cement i.e. its compressive strength, Consistency, I.S.T, F.S.T . The conclusion is based on the investigation of properties of mortar containing the above binders.

*Keywords:*Cement , Concrete;Mortar, Ordinary Portland cement, Pozzolona

1. Introduction

Ancient mortars were made from burned gypsum and sand while later development in mortar technology utilized a combination of lime and sand. These mortars developed their strength slowly (through a process of carbonation). Since about 1900, Portland cement has been incorporated into mortar to provide more rapid strength development. Modern mortar is composed of cement and lime or masonry/mortar cements, masonry sand, water, and possibly some admixtures. There in an increase in compressive strength of all the mortar mixes with 12% replacement of cement with pozzolanic material when compared to control mortar. There in increase in flexural strength of all the mortar mixes with 12% replacement of cement with pozzolanic material when compared to control mortar.[1] Brick waste is investigated for its use as a replacement of cement and sand in cement mortar as it behaves as a pozzolana. It may make an important contribution towards decreasing the adverse effect of the production, disposal and

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the dumping of brick waste on the environment. The results show that richer mixes give lower value of bulk density and higher values of compressive strength for sand replacement with brick waste up to 40%. [2]. It is well known that Portland cement production is an energy-intensive industry, being responsible for about 5% of the global anthropogenic carbon dioxide emissions worldwide. An important contribution to sustainability of concrete and cement industries consists of using pozzolanic additions, especially if obtained from waste such as waste glass.[3].

1.2 Procedures for using different binding agents in mortar:

Mortar is basically a cement sand ratio of 1:3. In this project we are replacing cement by waste products either partially or fully. The mortar is thus prepared by combining:

Cement: Cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The ordinary Portland cement of grade 53 will be used in the study.

Sand*:* Fine sand is to be used after proper sieving. Sand is mainly used as an inert material to give volume in mortar for economy.

Brick Powder &Glass Dust: It is used as partial or full replacement of cement in cement mortar.

Water: The binding property of cement activates in presence of water and thus mortar is prepared. The cement: sand ratio in mortar is 1:3. In this project we will be limiting the cement ratio to lesser than 1, e.g.0.5cement: 0.5 waste material (one among above): 3 sands. The mixing is then done followed moulding and then curing. The casted cubes are then tested after 3,7,14 days for compressive strength, setting time.

1.3 Objective

1. The main objective of the study is to use the pozzolanic materials other than cement for the positive variations in the properties of the mix and also its impact on the economic growth of the construction industry and to explore the use of replaced materials.

2. Further, the effect of materials used as admixture is to be determined by testing Compressive strength, Consistency and Setting Time of cement mortar. These tests will enable a complete characterization and an evaluation of application possibilities.

2. Research Method

Table 2.1 Materials used:

Cemenet
Sand
Water
Brick Powder
Glass Dust

Table 2.2: Chemical characterization of glass residue (main constituents).

Oxide	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O
% by mass	73.99 %	1.02%	0.18%	8.56%	3.33%	12.55%	0.24%

Table 2.3. Composition of bricks

Alumina	30%
Silica	55%
Magnesia	5%
Iron oxide	8%
Lime	< 5%

Figure 2.1: Brick dust after sieve analysis

2.2 Methodology

Three of the tests in the testing program required mortar formulations with established proportions of cement, sand, and additive (brick dust and glass dust). The proportions used in these formulations were derived from past research. The cement: sand ratio was taken as 1:3 by weight. The cement content in each formulation was varied. Three formulations were used for the Glass dust and three formulations for Brick dust with one standard Mortar formulation. The various proportions of the cement, glass dust, brick dust used in the project is given in the table below:

Table 2.4 Percentages of cement, glass dust and brick dust.

Cement	Glass dust	Brick dust
100%	0%	0%
90%	10%	—
90%	—	10%

The specimens were casted in standard size moulds having the suitable dimensions. After 24 hours the specimens were demoulded and stored until the day of testing. Specimens for each mix proportion were tested at the ages of 3 days, 7 days and 14 days, in order to determine compressive strength, setting time, durability etc. The main parameters of the study were the type of cement and the percentage of cement replacement that may be glass dust, brick powder or clay. The replacement percentage was considered from the entire volume. The water to binder ratio was kept constant for all mix proportions. The amount of mixing water varied among the mixes depending upon the type of additive used. Approximate water requirements were determined before the mixing of formulations through preliminary tests in which mortars were mixed to the appropriate consistency. Each mortar formulation was subjected to the Consistency test. Cubes (6.7cm x 6.7cm x 6.7cm) were casted for compression testing. The first step in the project was to collect the raw materials to be used as cement replacement.

Then the Consistency of the above formulations was checked using Vicat's Apparatus. After that the casting was started. Nine samples were made for each formulation and for each test followed by the testing of samples at 3 days,7days and 14 days.

2.2.1 Collection of raw materials:

Brick dust was obtained by crushing the bricks manually using a hammer, the glass dust was obtained from the ongoing construction of buildings. Cement is a dispersed solid whose particle size is ranging from 0.1 to 250 micron-meter. The glass dust and the brick dust thus obtained were brought down to a size comparable to the size of cement particles. For this purpose, the Glass waste obtained was first broken down completely in the Abrasion testing machine and using hammer and then the sieve analysis was done to obtain the glass dust passing 150-micron sieve. The brick dust obtained was directly dried followed by the sieving of brick to obtain brick dust passing 150-micron sieve.

2.2.2 Mixing

The cement: sand ratio of 1:3 was taken and the calculations of each constituent were done by weight total weight for each sample being 300gms. The water/cement ratio was kept as 0.48 for all mixes. However, slight modifications were made because of the differences in consistency and mixing requirements for glass dust and brick dust.

The proportioned mix was blended together by hand, and then water was added to it in small quantities. The mortar was mixed continuously by hand using trowels till the appropriate mortar consistency is reached.

Table 2.5: The proportion of constituents in each mix (by weight).

Replacement of Cement	Sand(grams)	Cement(grams)	Glass(grams)	Brick(grams)
__	225	75	__	__
10%	225	67.5	7.5	__
10%	225	67.5	__	7.5

Figure 2.2: Mixing of raw materials

2.2.3 Moulding for cubes

The cubes for testing compressive strength of mortar are made of cast iron with side of 6.7cm. These moulds were first cleaned and then greasing was done. The freshly mixed mortar was then brought for filling into the moulds. Moulds were overfilled with fresh mortar and continuously compacted to minimize voids. The tops of the overfilled moulds were smoothed with a trowel and then the excess was sliced off. The cubes were then kept undisturbed for 24 hours. After 24 hours the samples were removed from the mould. For each mix, a total of 9 samples were made for testing for 3 days, 7 days and 14 days strengths.

2.2.4 Curing After 24 hours the cubes and beams were removed from the moulds and kept for curing in buckets and plastic jars. The curing was done for a period of 7 days for cubes after which they were checked for compression. Nine samples for each mix were made for compression testing out of which three were cured for 3days, three for 7days and three for 14 days after which testing was done. In this project curing was done by ponding the samples in water.

3. Tests, Results and Analysis

3.1 Tests

3.1.1 Consistency test:

In the project we weighed approximately 400g of cement and mix it with a weighed quantity of water. The mixing is done for a time between 3 to 5 minutes.

3.1.2Compression Test:

In this test 75gm of cement and 225gm of standard sand in the proportion 1:3 (by weight) was taken. The cement and sand was than mixed in dry condition with a trowel for 1minitues and then water was added. The quantity of water was taken as 37.5 gms. (W/c ratio= 0.48). After mixing the mortar, the mortar was placed in the cube mould and compacted by means of a rod about 20 times in about 8 seconds to ensure elimination of entrained air. The cubes were then placed the cube moulds for 24 hours. After 24 hours the cubes were removed from the mould and immediately submerge in clean water till testing. Three samples were made for each test. The above procedure was carried out again for the cement proportions and the compressive strength at 3 days, 7 days and 14 days was obtained. The Cubes were placed in the compression machine care being taken that the load is applied to a face cast against the steel face of the mould.

3.2 Results

The results show the variation in consistency, Compressive strengths of various mortar mixes in which the cement is replaced by various percentages of glass dust and brick dust. The results also show the variation in Compressive strength of Brick Prisms casted for one mix of Glass dust and one of Brick dust.

3.2.1 Consistency

Table 3.1: Consistency Test

For standard cement	Consistency = 0.30 W/C RATIO
For 10% replacement of cement by glass dusts	Consistency = 0.33 W/C RATIO
For 10% replacement of cement by brick dust	Consistency = 0.32 W/C RATIO
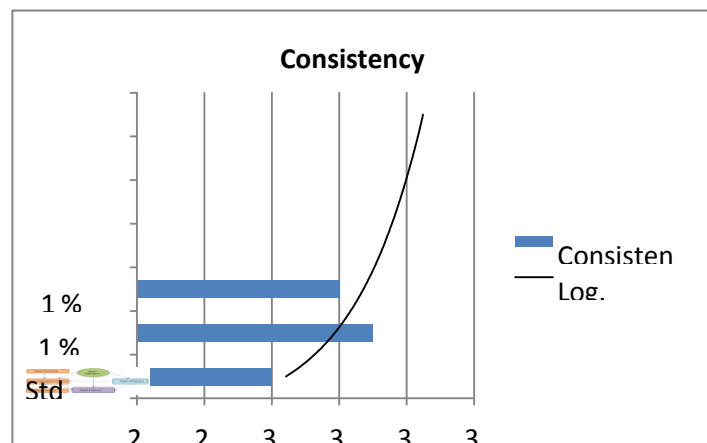
Figure 3.1: Chart showing variation in consistency with different replacements.

3.2.2 Initial/final setting test:

Table 3.2 :Initial/final setting test

Standard mix	**10% Replacement of cement by glass dust**	**10% Replacement of cement by brick dust**
Initial setting time = 25 min	Initial setting time = 20 min	Initial setting time = 30 min
Final setting time = 580 min	Final setting time = 550 min	Final setting time = 620 min

3.2.3 Compression test:

3.2.3.1 For standard mortar:

Table 3.2: Compression test: for standard mortar

Compressive strength for 3 days	6.3MPa	5.1MPa	6.5MPa
Compressive strength for 7days	8.5MPa	8.9MPa	8.5MPa
Compressive strength for 14 days	14MPa	13.4MPa	13.2MPa

\

3.2.3.2 For 10% replacement of cement by glass dust:

Table 3.3 Compression test for 10% replacement by glass dust

Compressive strength for 3 days	5.7MPa	5.9MPa	6MPa
Compressive strength for 7days	9.3MPa	9.7MPa	10.4MPa
Compressive strength for 14 days	18.2MPa	17.5MPa	17.9MPa
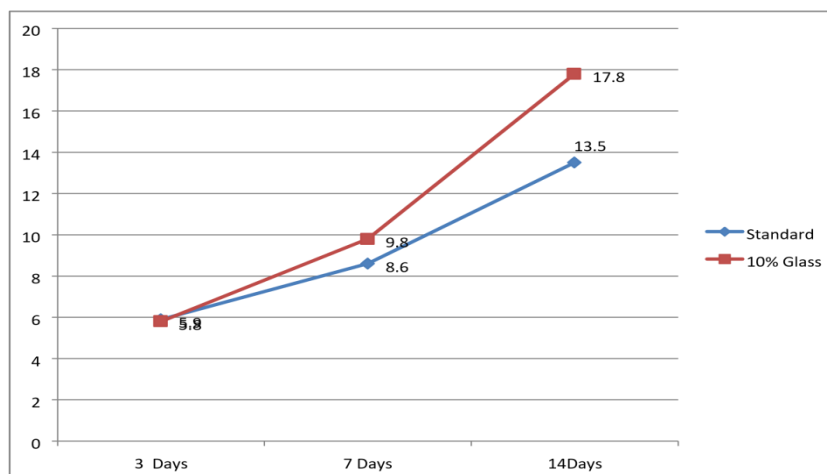
Figure 3.2 : Graph showing comparison of compressive strength of standard mortar and mortar with 10% cement replaced by glass dust.

3.2.3.3 For 10% replacement of cement by brick dust:

Table 3.4 For 10% replacement of cement by brick dust:

Compressive strength for 3 days	5.2MPa	5.1MPa	5.2MPa
Compressive strength for 7days	9.6MPa	9.4MPa	9.4MPa
Compressive strength for 14 days	14.1MPa	13.8MPa	14.4MPa
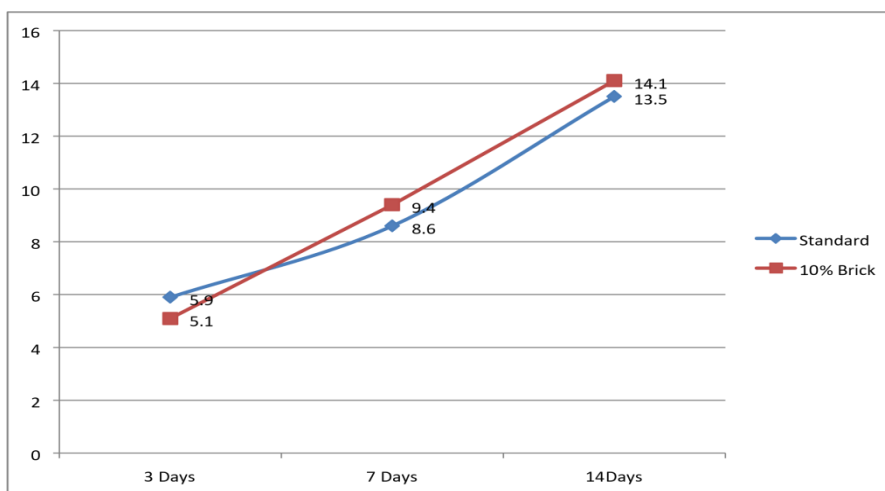
Figure 3.3 : Graph showing comparison of compressive strength of standard mortar and mortar with 10% cement replaced by brick dust.

3.3 Analysis

- Addition of Glass powder as well as brick improved compressive strength of mortar. Compressive strength of mortar increases in results comparable to standard mortar with increase in glass powder dosage up to 10% replacement to cement.
- The compressive strength of normal mortar cube using cement and sand in the ratio of 1:3 for 3,7,14 days of curing was (5.8MPa, 8.6MPa, 13.5MPa) respectively.

   The strength of the cube by replacing cement with 10% of glass dust for 3, 7, 14 days of curing was (5.8MPa, 9.8MPa, 17.8MPa) respectively.

- The strength of the cube by replacing cement with 10% of brick dust was (5.1MPa, 9.4MPa, 14.1MPa) respectively.
- So, the optimum percentage of Glass powder found from experiment is 10%. For brick dust, the compressive strength came out to be comparable to standard for 10% replacement.

Conclusion

It is considered that the glass powder form would provide much greater opportunities for value adding and cost recovery, as it could be used as a replacement for expensive materials such as cement. It was observed that the glass mortar showed higher values of strength earlier than the standard mortar i.e.it gained more than half of its strength in just 3 days of curing when the Standard mortar showed lower strength values. Further increasing trends in initial and final setting was also observed which could be due to fineness of replacement materials causing increase in rate of hydration.

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COST ESIMATION OF G+2 RESIDENTIAL BUILDING

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Abstract

Any construction project will be start with the Layout of the building and structure followed by Design and Analysis of the structure which is succeeded by cost estimation and planning for the said project. This project involves the layout, design, analysis, planning and cost estimation of a G+2 residential building located in Surkh Abad , Dasht -E-. Barchi Kabul Afghanistan.The layout of the proposed G+2 residential building is based on a plot of size 15 x 20m Previously the plot was being used as car parking, but now it will be used as a multi-storeyed residential building. The ground floor of the building will be used as shops and the remaining 2 floors will be divided into 2 apartments each having an area of 150sq m. Each apartment is of 2BHK configuration. All the drafting was done using AutoCAD. Also these drawings made on AutoCAD also served as a base for transfer of the structure for analysis and design into STAAD Pro by my brother Engineer Hamidullah Hussaini. As my job was estimating of total cost of that project. The analysis and design of the entire structure has been completed using STAAD pro.The results include the various forces acting on various members of the building like beams columns slabs. By using this software we got the amount of concrete as well as the weight of the various reinforcement bars thus easing the load of cost estimation. The foundation has been designed by staad foundation as an isolated footing using soil condition as medium. The foundation design values were calculated using STAAD Foundation. The cost estimate for the project has been calculated using Centre Line Method in Microsoft Excel. The total cost of the project came aboutRs. 40,00,000 afg has been calculated.

*Keywords:*AutoCAD,Cost estimation;G+2;STAAD pro;MS Excel;MS Project.

1. Introduction

Estimate or estimating is the process or prediction of a quantity based on the experience or any information available at that time, or it is the creation of financial statement which is not the exact value. The total expenditure that we spend on a project is called cost of that project, construction or operation.Eg: Area, materials, labor charge, electric and machineries plus extra expenditure of natural effects. Orcost estimation is the amount of money forecasted to spend on a project + - variables. A cost estimated may have different value than compare to the actual value of a project. Cost estimate is not coming 100% true. Estimation is the way or methods of calculating or computing the various quantities and expected expenditure to be incurred on a particular work or project. The problems with a cost overrun should be avoided with a credible, reliable, and accurate cost estimate.

These are the requirements which are necessary for preparing an estimate

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- Drawing like plan, dimensions, elevation and sections of important points

- Detailed specification about workmanship & properties of materials.

- Standard scheduled of rates of the current year.

Construction or operation cost andthe problems with a cost overrun should be avoided with a credible, reliable, and accurate cost estimate.A cost estimators are those who prepare cost estimates by using different methods and different software, it might be Microsoft Project or Microsoft Excel or any other software. There are different types of cost estimators, suchas building estimator or electrical estimator, or chief estimator. Other professionals such as quantity surveyors and cost engineers may also prepare cost estimates or contribute to cost estimatesany project construction will start with architectural followed by design and analysis of structure and after that by cost estimation and planning of project. This project involves the AutoCAD layout, structural design, planning and cost estimation of G+2 residential building located in Surkh Abad Kabul Afghanistan. For completing the project popular Civil engineering software such as AutoCAD for planning the layout, STAAD Pro for structural design, Microsoft excel and Microsoft project for estimation purpose has been used. STAAD pro allows designers and structural engineers to design and analyses virtually any type of structure through its very flexible modeling environment, fluent data collection and advanced features. STAAD pro supports over 70 international codes including IS456:2000 IS800:2007 and over 20 U.S codes in more than 7 languages. The GUI or Graphical User Interface or user communicates with the STAAD Pro analysis engine through the standard input file. That input file, a text file consists of a series of commands which are sequentially executed. AutoCAD is a commercial software application for 2D and 3D computer aided design and drafting for various fields in engineering like civil, mechanical, electrical, automation, architecture etc. It was first launched in 1982 by Autodesk, Inc.It allows architectures to draw 3D and 2D objects, ex: walls,doors and windows, with more intelligent data associated with them rather than simple objects. The data can be programmed to represent products sold in the building industry, or it can be extracted into a file for pricing material estimation etc. AutoCAD or Computer Aided Design is a very helpful tool in drafting and designing any structure. AutoCAD uses a Graphical User Interface for the purpose of drawing or layout and designing any structure. The software has many other indexes for complex drafting. Microsoft project has been used in this project to create the Gantt chart, date of start and date of finishing of projecttime duration, task name, percentage of completed work, and gantt chart is shown in the Microsoft project,Project cost estimation is the process of predicting the quantity, cost, and price of the resources required by the scope of a project. Since cost estimation is about the prediction of costs rather than counting the actual cost, a certain degree of uncertainty is involved, like the cost estimation of a single project did not came 100% accurate yet. This uncertainty arises from the fact that the project scope definition is never entirely complete until the project has been finished, at which point all expenses have been made and an accountant can determine the exact amount of money spent on resources. Excel is a typical spreadsheet or chart which is mostly used in cost estimation and also sometimes for planning purposes. Excel has various calculation tools inside it which can be used for complex calculation. Apart from that one can also input one's own formula for special calculations. The user interface is very friendly and easy to use. There are around Rows: 1,048,576 Columns:

16,384, which make it easier for the user to enter a large amount of data into a single spreadsheet. Also there are features like the auto correct which make changes to the entire document if there is an error in inputting an entry. This makes the job the less redundant and easier for the Estimator.

ID	Task Name	Start	Finish	Duration	Complete
1	⊟ Task Name	2015-05-01	2015-05-13	9.0 d.	50%
2	Task Name	2015-05-01	2015-05-07	4.5 d.	100%
3	Task Name	2015-05-07	2015-05-13	4.5 d.	0%
4	⊟ Task Name	2015-05-07	2015-05-28	15.5 d.	32.5%
5	Task Name	2015-05-07	2015-05-15	6.0 d.	41.7%
6	Task Name	2015-05-15	2015-05-28	9.5 d.	42.1%
7	Task Name	2015-05-22	2015-05-28	4.5 d.	0%
8	Task Name	2015-05-01	2015-05-13	9.0 d.	0%
9	Task Name	2015-05-14	2015-06-01	13.0 d.	0%
10	Task Name	2015-05-14	2015-05-14	0.0 d.	0%

Fig1.1 MS Project used for Ghant Chart

2. Research Methology

2.1 Study of IS 875 1987

IS 875 deals with the various load cases that act upon a structure and ways to calculate them. There are various parts of the code that deal with the various load types such as dead load (DL), live load (LL), wind load (WL, snow load (SL) and various special loads and load combinations. As the building is situated in Surkh Abad Kabul and is not a high rise building, loads such as wind and snow were not considered in the design process. The Code gives the unit weights of various materials as well as the values of imposed loads that act in various types of structures and parts of these structures. As there is no much earth quake then we will not consider the earth quake load as well, and if there is any earth quake it might be very less amount ex: $2 - 3$ Richter.

2.2 Preparation of Building Layout using AutoCAD

The layout and plan of the building is prepared by an architect, and shared with structural engineer and me.The layout or floor plan was drawn on AutoCAD. That had given the directions and various layouts then discussed with the architect for error correction.

Basics: This section reviews the basic AutoCAD controls. Viewing: Pan to zoom in the drawing, and control the order of overlapping objects. Geometry: Create or draw anygeometric objects like lines, circles, and hatched areas.
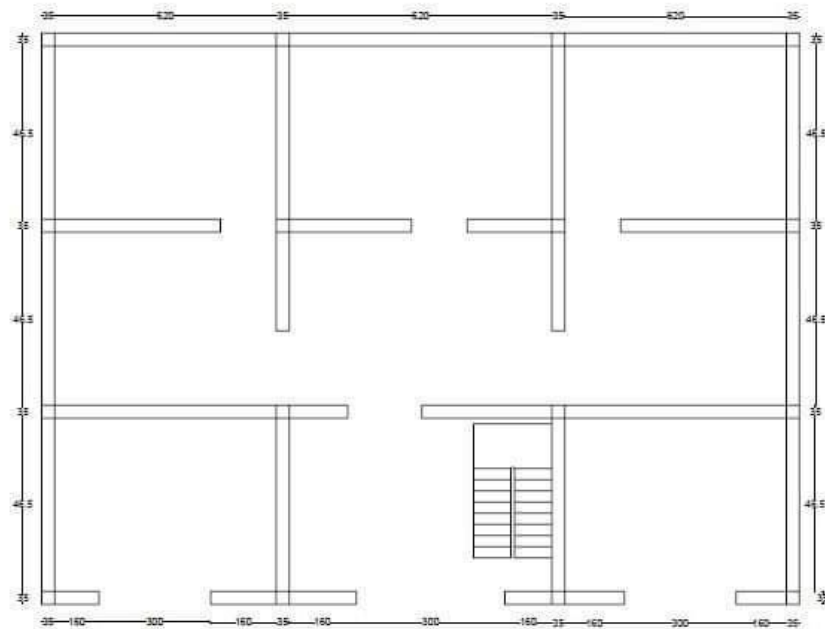
Fig 2.1 The layout is showing of a two apartments of 2BHK each, ground floor is using as shops and two other floors are using as residential purposes

2.3 Cost estimation using excel

Using excel to create a chart and give all data to the chart like task name, serial number and measurement details then calculate all that and find the result.

As excel has spreadsheet so we can save many more data, it is a user friendly program that rows and columns then we can enter data in it and calculate.

The total steel and concrete requirement is calculated by STAAD Pro reducing a lot of calculation. Remaining calculation left to be done is the calculation of walls, cement plaster, doors and windows, earthwork and foundation. The calculations are based on the centreline method   or   long wall short wall method which is quite easy to do by Microsoft excel.

2.4 Use Microsoft project

Ms Project is a project management softwarewhich is using to draw gatt chart and tasks information, developed and sold by Microsoft. It is designed to help a project managerto do the scheduling, assign resources to work tasks, managing the budget, and analyzing workloads. This project creates budgets, estimate the time duration based on assignment work and resource rates. As resources are given or assigned to tasks and assignment work estimated, time duration of every task will be calculated then program calculates the cost, that depends to the work times the rate, and that also depends on the task level, then to any summary of work task and finally to the project level. Resource definition (labours, equipment and materials) can be shared between projects using a shared resource pool. Each resource having its own calendar to calculate work span, and defines which working days and shifted days times of working days.

2.5 Layout of G+2 building using AutoCAD

AutoCAD or Computer Aided Design is a very helpful tool in drafting and designing any structure . AutoCAD uses a Graphical User Interface for the purpose of drafting and designing any structure . The software has various inbuilt tools for complex drafting. Also AutoCAD can be used for 2D, 3D and for perspective design.

Table 1 General Layout Details

Area of Plot	20 * 15m
FAR	2.25(allowed)
Plot details	Front Surkh Abad bazar road, left side is school road, back and right is private residential houses;
Number of Floors	G + 2
Number of Units	4 each total
Type Apartment	2 each floor
Area of Each Apartment	10* 7 m

3. Analysis and Design using STAAD Pro

Once the layout and   floor   plan   of the building was completed by the architect the plan   was shifted from AutoCAD to STAAD Pro using a DXF file format, or we can draw the same layout in the STAAD   Pro and extend the volumes or go for further process.

Once the layout was transferred, multiple stories were created using the Translational Repeat To ol in Staad Pro. After this member properties were assigned. Next the load cases were generated and applied to the structure. Once the loads were applied the structure was analysed and correctio ns were made to the

structure for the various errors that were generated while the structure was being analyzed.After t he analysis, we started designing the structure by entering thedesign tab in STAAD Pro.   and slabs.It was analyzed and result will be shown on the screen.

The original structure and 3D view of the project located in surkh Abad, Dasht E Barchi As the ground floor of the building is 85% completed, its started as using shops. The rest two floors are under construction which will be using as residential.
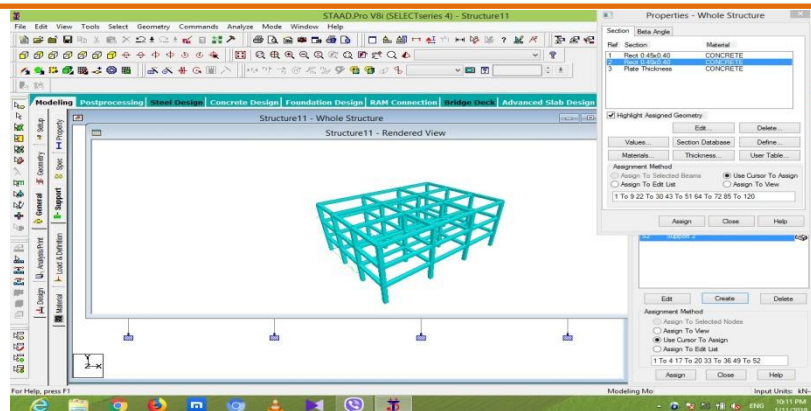
Fig 3.1 STAAD Pro plan

Fig3.2 The original structure

5.1 Conclusion

This project includes the layout of G+2 residential building using AutoCAD, Analysis and Design using STAAD Pro, concludes with the cost estimate using Microsoft excel and ms project for the entire project. The layout of the proposed G+2 residential building is based on a plot of size 20m x 10m located at Surkh Abad, Dasht E Barchi, Kabul Afghanistan. Previously the plot was being used as a car parking, but according to the new plan it will be used as residential building. The ground floor of the building will be used as shops and the remaining 2 floors will be divided into 2 apartments each having an area of 150sq m. Each apartment is of 2BHK configuration. All the drafting was done using AutoCAD. Also these drawings made on AutoCAD also served as a base for transmit or shifting of the structure for analysis and design by STAAD Pro. The design of the entire structure has been done using STAAD pro. The results include the various forces acting on various members as well various schedules for various members. The foundation was designed as an isolated footing as mostly used, using soil condition as medium. The foundation design values were calculated using STAAD Foundation. The cost estimate for the project has been calculated using short wall long wall Method in Microsoft Excel. For the Abstract cost CPWD Schedule of rates has been followed and a total

cost of Rs 40,00,000 has been calculated. Indian code and DSR has been used as the rate of material in India and Afghanistan is the same rate, discussed with HOD of civil department of Polytechnique university of Kabul.

Introduction to estimation and estimators

Introduction and definition of estimation, requirements of estimation, methods of estimation has been explained, which softwares are using for the cost estimation, and DSR has been explained.

Types of estimation using soft wares

1. Auto CAAD

Auto caad has been used manually and drawn the floor plan, and given dimensions

2. Staad pro

Staad pro has been used manually to draw the structural design, no. of footing and no. of columns, beams and design of slab.

3. Ms Project

4. Microsoft office

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 [2]
Estimating, Costing, Specifications & Valuations in Civil Engineering By Monojit Chakraborti.

[3]*CPWD Schedule of Rates for Delhi.*

A STUDY ON APPLICATION OF MATHEMATICS IN TEMPLE ARCHITECTURE – SOUTH INDIAN TEMPLES

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Introduction

Sir Isaac Newton and Gottfried Wilhelm Leibniz have developed differential calculus, independently, without knowing each other in the middle of 17th century only. Before Newton and Leibniz, the word "Calculus "referred to anything in Mathematics, but from the mid of 17th centaury onwards it referred certain branch of Mathematics deals with functions and rate of changes like that. However, so many wonderful and spectacular Temples have been built a thousand years ago. We often admire on seeing the construction of temple, monumental tower dome and wonder and discuss how these were built at that times when there were no much techniques? But, the surprisingly beautiful construction would not be possible without the help of mathematics technique. In fact, they have used very simple formulae and measuring techniques to measure and built Temples. The only thing is that they followed those systems of measurements one hundred percent accurately without compromise. An "anu" is the very smallest measurement in their units. It is very hard to see and use. The following tablie-1 provides us few steps from the anu measurements.

This measurement could be used only by the Sthapathi, he is known as master builder or vishvakarma and nobody else can do it. A Sthapathi is an expert of Veda, Universe and the geological knowledge of them. Such a Sthapathi only can build a temple like Thiruchenthur Murugan Temple because that temple was not affected by the Tsunami. Even the temple was built nearer to the bank of Ocean it was not affected by the Tsunami only because the Sthapathi had constructed it according to the geological system of earth as well as universe.

Table: 1 Standard Unit

Sl. No.	Standard Units	Descriptions (nearly)
1	1 anu	1 paramanu (not splitable & hardly visible)
2	8 anu	1 ratha renu (dust)
3	8 ratha renu	1 balagrasa (hair end)
4	8 balagrasa	1 grain of yava
5	8 yava	1 angula
6	12 angulas	1 vistasta or tala
7	2 tala	1 hasta (24 angulas)
8	26 angulas	1 dhanurbhagha (handle of a bow)
9	8 hates	1 danda
10	8 dandas	1 rajju (robe)
11	1000 rajju	1 yojana
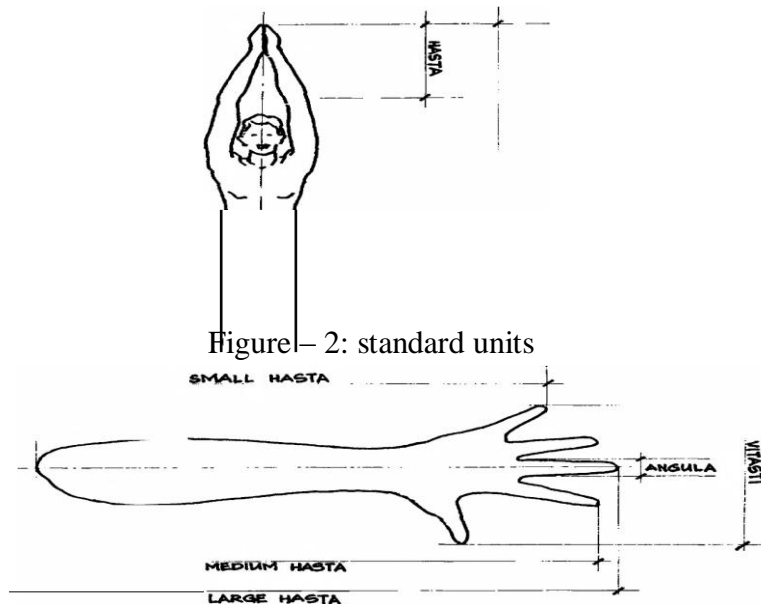
Figure – 2: standard units

A temple is not a building to sit, live and do business to construct by using cement and bricks. It is a place of knowing things which behind our perception of organs. The entire universe had been through some religious rituals. A thousand years ago, the colour of mars (red) and mercury (green) have been found. Text of astronomy, today's science confirms that belief as true. Even the distance, weight and orbit were calculated by ancestor.

The Dhwaja – sthamba should be perpendicular and placed directly opposite to the idol. A line drawn at an angle of 22 ½ degree from the mid- point between the brows of the idol

should cut the top of the Dwajasthamba. The height of the Dwajasthamba thus is related to the height of the image. Some scholars say, this perhaps is relates to the axis of the earth which makes an angle of 22 ½ degree with the sun. Sometimes, a hoe is made in the roof of the mantapa, at the point where the imaginary line drawn from the idol emerges out the roof of the mantapa, on its way to reach the top of the Dwajasthamba. Thus, it is ensured that the midpoint between the brows of the idol, the hole in the roof and the top of Dwajasthamba are all aligned along one straight line. The line when extended further from the top of the Dwajasthamba should touch the Kalasha on top of the Gopura. Thus, the distance and the height of the Gopuram get related to the height of the idol and the Dwajasthamba.
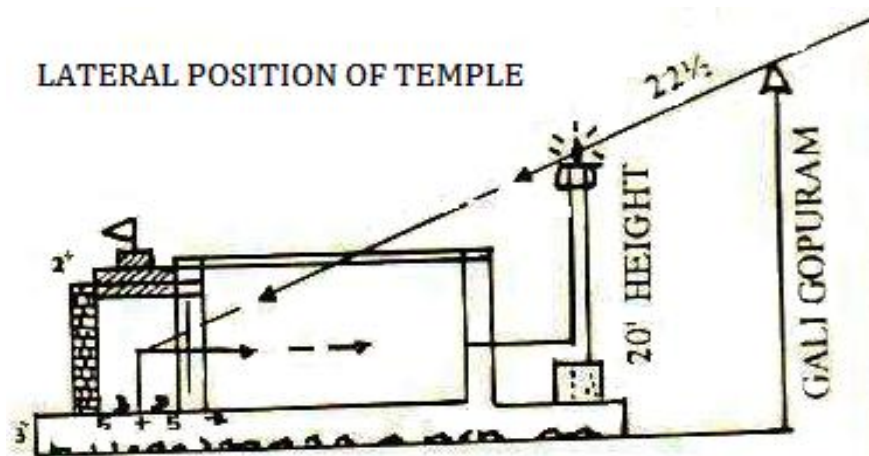
Figure – 3: Lateral Position of the Temple

'The Sulba Sutras' provides several geometrical principles and implication ideas to construct temples.
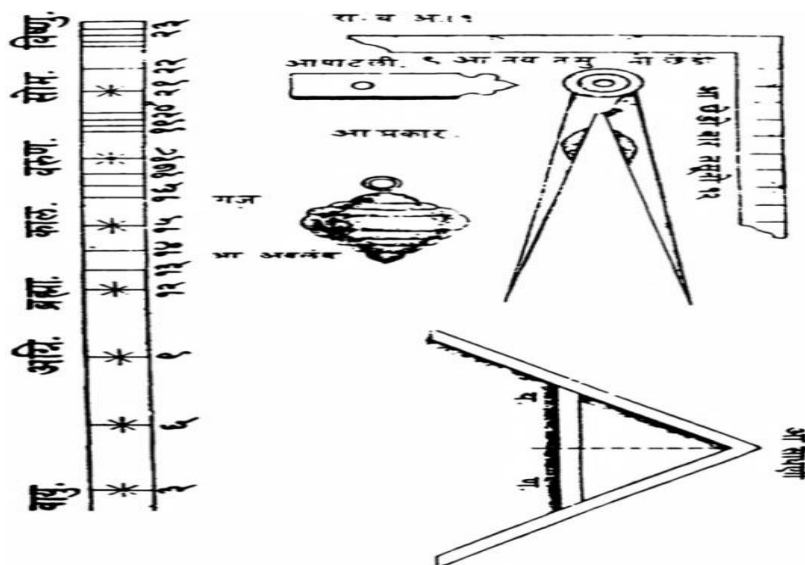
Figure – 4: Geometrical Measurement

Ancient Indian mathematicians were very skilful in geometry. They used the knowledge of geometry in other disciplines also. They derived many of the comprehensive conclusions with the help of geometry. The Indian old scripts are the evidences of those practices. The concept of progression can also be applied in the geometry. When this progression held in a proper manner or following a rule, it becomes a process, which has several names like iteration, repetition etc. Ayathi Mathematics is the accurate measuring method followed in the temple construction process right from the beginning to till now. This mathematics determines the space required to construct the temple for each god.
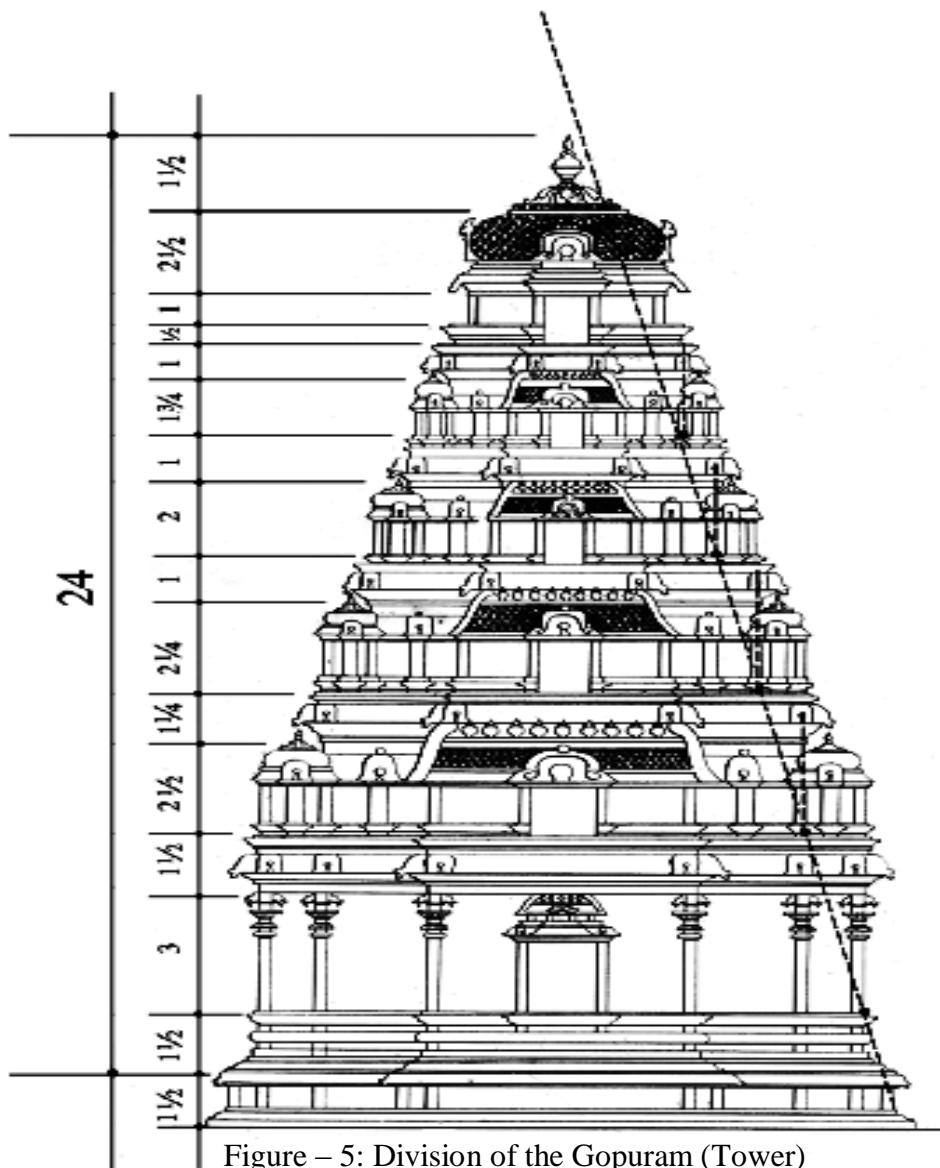
Figure – 5: Division of the Gopuram (Tower)

The height of the gopuram (Vimanam), width and location also readily prescribed in Ayathi Mathematics as follows

Level/storey (tala)	Prescribed height	Remaining height (RH) from bottom of level to top of temple	Width of level = RH/√2
5th tala	3.50	10.00	7.07
4th tala	4.00	14.00	9.89
3th tala	4.25	18.25	12.90
2th tala	4.50	22.75	16.08
1st tala	4.50	27.25	19.26
Base	2.50	29.75	21.03

Table – 6: Standard height of the Gopuram

The goal of a temple design is to bring about the descent or manifestation of the unmanifest and unseen. The Vastu–Purusha- Mandala represent the manifest form of the Cosmic Being; upon which the temple is built is built and in whom the temple rests. The temple is situated in Him, comes from Him, and is a , manifestation of Him. The Vastu –Purusha- Mandala is both the body of the Cosmic Being and a body's device by which those have the requisite knowledge attain the best results in temple building.

Figure – 7: Vasthupurusa Mandala Structure
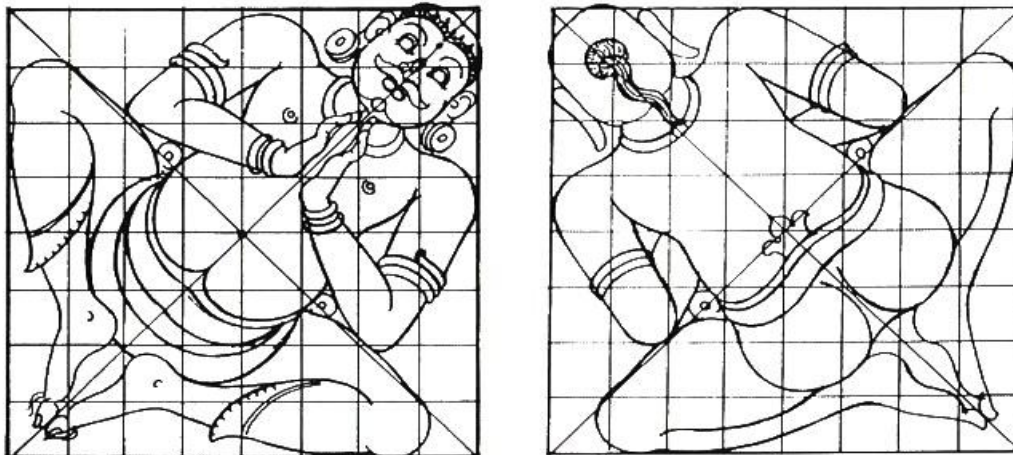
In order to establish the Vastu Purusha - Mandala on a construction site, it is first drafted on planning sheets and later drawn upon the earth at the actual building site. The drawing of the Mandala upon the earth at the commerencement of construction is a sacred rite. The rites and execution of the Vastu Purusha- Mandala sustain the temple in a manner similar to how the physical foundation supports the weight of the building.
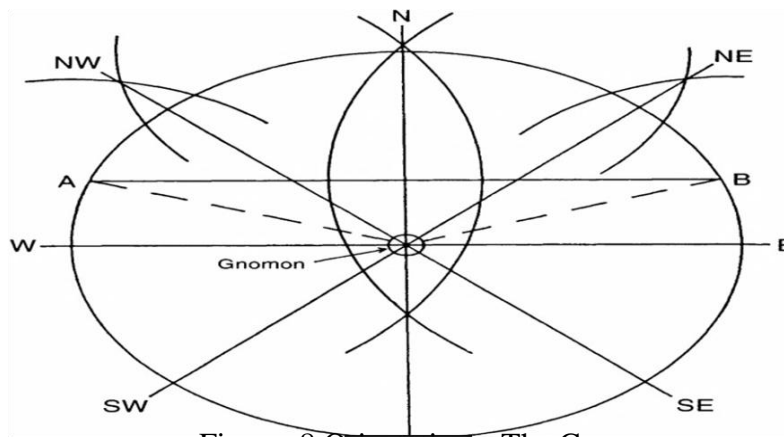
Figure: 8 Orientation – The Gnomon

It directs us to follow standard units strictly on the construction without compromise. My research correlates the basic mathematics with the construction of monumental temple tower which serves as a God's residence. My thesis defines and determines the specialty of construction and Mathematical usage. The aim of my research is comparing the basic Mathematics with modern civil engineering technology and exploring the specialty of basic mathematics. The Geological locations and the cosmic power of the Linga in Thiruvannamalai have been correlated with ancient text. This paper elaborates it and concludes the technique of the temple construction as well as the role of old age Mathematics.

Layout and style of temples

Based on the temple layout the construction is progress. In the layout the godes are places on the bases of the vasthu purushamandala according to the directions and agamas.
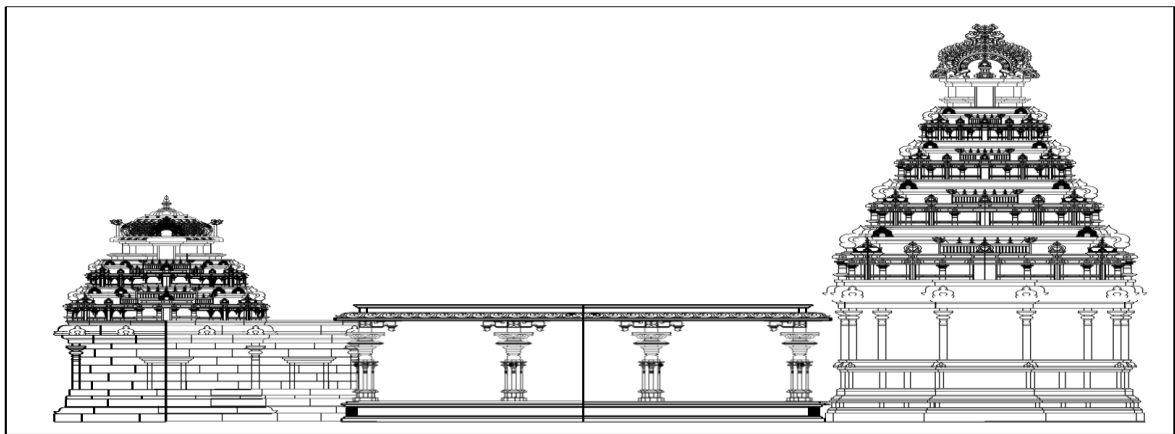
Figure – 9: Ayathi mathematics

The garbagraha is encircled by the first prakara, called antara-mandala. This is a passageway, often narrow, permitting the devotees to circumambulate the sanctum in a customary act of devotion. The flight of stairs that connects the first prakara with the sanctum sanctorum is called the sopana. In front of the sopana is the main mantapa.

Around the main mantapa and antara-mandala is the second prakara (antahara). This forms a broad verandah with doorways on all four sides. The antahara leads out into an enclosure containing the main bali-pitha. The next enclosure is called madhyahara. Beyond this and just outside the main bali-pitha is the flagstaff (dhvaja-stambha). The fourth enclosure is called bhayahara. The fifth prakara (enclosure) is the maryada

 (limit), or last wall.
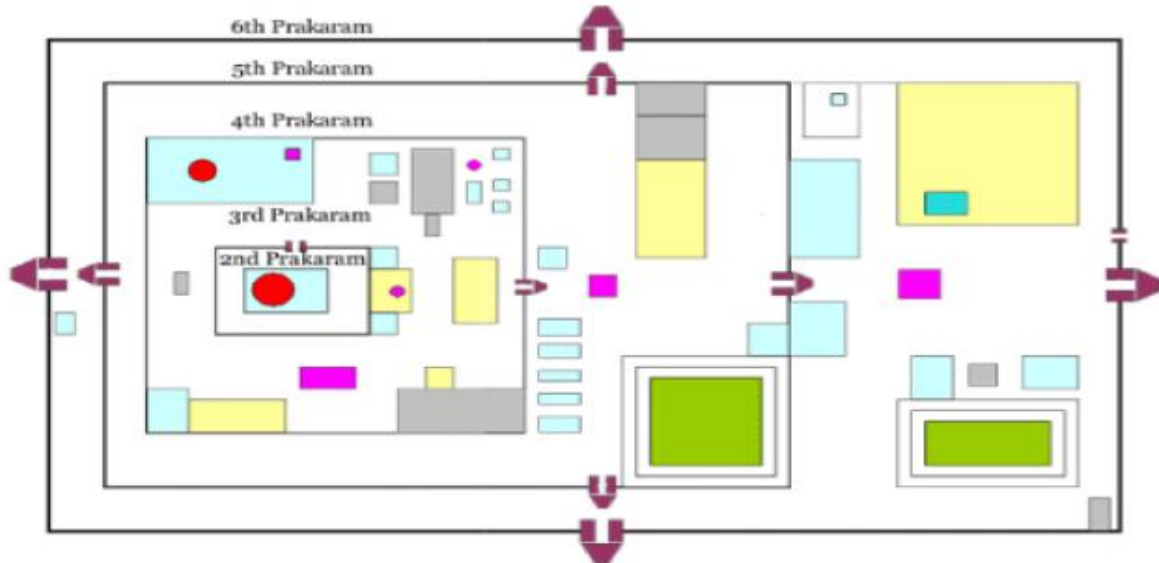
Figure –10: Layout of Tiruvannamalai Temple

The Agama literature includes the Shilpa- Shastra, which covers architecture and iconography. The aspects of temple construction are dealt in Devalaya Vastu; and Prathima deals with the iconography. Sometimes, the term Shipa is also used to denote the art of sculpting; but here Shipa refers to the practice of the technique, while Shastra refers to its principles. In Tiruvannamalai Temples lot secrete behind there. The temple construction made my "Anu" based the angula measurement are used to constructed.

Figure –10: Arial View of Tiruvannamalai Temple

The finding of this temple is Ten Gopuram is there. It was located at the near the Sambantha vinayagar Temple, But it not known to anybody. In future any mathematician or any sapathi's must to find the truth of my finding in my thesis. Moreover inside of the temple one place there is space is not be visible behind the garbagraha of the shiva temple. In this place the temple architecture of the sapathi can only to known the reason of the place to hide inside of the temple.

CONCULSION

Basic mathematics is the base for our life style and sky high building culture is based on it. Mathematics is the excellence of art. Our traditional mathematics policies serve as a challenge for new scientific research.Net every mathematics go along with life, art and culture. But our basic mathematics only stands at top in our worldwide science research. Only our mathematics joins hand with our life, art and culture. The basic mathematics has been formulated by Saints, Rishis and sages and published as spiritual mathematics, astrological mathematics and building vasthusasthra books.

This research correlates the basic mathematics with the construction of monumental temple tower which serves as a God's residence. This research defines and determines the specialty of construction mathematics and its usage. The aim of my research is comparing the basic mathematics with modern civil engineering technology and exploring he specialty of basic mathematics. Moreover, my research explores that the calculation of each stage of temple construction is related to each other and they are correlated with atom table. In other construction, Specific calculation method part is utilised for each individual part of construction whereas, the calculations applied in constructing a temple should always be related to the calculations established for constructing the base.

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INFORMATIVENESS OF OPTIONS' OPEN INTEREST IN INDIAN EQUITY MARKET

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ABSTRACT

In this paper, using an open interest based price predictor for Bank Nifty index, we find strong predictive power from the options market on the underlying Bank Nifty index. This evidence is supported by out-of-sample tests of an active trading strategy using open interest based predictor calibrated from in-the-sample period. Using Bank BeEs as the underlying assets, practical application of this strategy has been demonstrated.

Keywords: Option open interest, information, trading strategy.

Introduction

Options have been traded for centuries, but they remained relatively obscure financial instruments until the introduction of a listed options exchange in 1973 (Cox *et al* 1979).Noteworthy studies of options in the financial literature began with the long-neglected thesis by Bachelier (1900) which was revived in the 1960's by a number of researchers. SinceBlack and Scholes (1973) found a straightforward formula to price options, option markets have been growing by leaps and bounds. Options trading is now the world's biggest business, with an estimated daily turnover of over 2.5 trillion US dollars and an annual growth rate of around 14%. Given such a high trading volume, the following question arises: What drives investors' trading in the securities market and the associated options market? Due to varied features of different markets, informed traders may choose to trade in particular markets and information is likely to be transformed into asset prices in these markets first. In this light, option contracts, because of the way they are structured and traded, have many inherent advantages over trading stocks. Trading incentives like lesser capital requirements, least trading restrictions and impounded higher leverage make the options market a preferred venue of trading for informed traders.

In complete markets, any information arrives simultaneously in the spot and options market. But in absence of market completeness traders with private information may prefer options market because of the economic incentives it provides than the underlying spot market. This line of thinking has encouraged theoretical modeling and empirical testing of informed trading in options. If any kind of information is first reflected in options market leading to price discovery process, it will be of interest to investors watching for signals about future price movements in underlying market. This implies that trading activity in options markets may be an important predictor of future security price movements. The asymmetry of information and the preference of trading venues would thus cause option transactions to convey information to market participants of impending changes in stock and option prices. This instinct can be traced back to the hypothesis of Black (1975) with a remarkable range of researchers includingManaster and Rendleman 1982, Bhattacharya 1987, Vijh 1988, 1990, Anthony 1988, Conrad 1989, Stoll and Whaley 1990, Stephan and Whaley 1990 DeTemple and Jorion 1990, Damodaran and Lim 1991, Chan *et al* 1993, Srinivas 1993, Sheikh and Ronn1994, Mayhew *et al* 1995, Fleming *et al* (1996) furtherinvestigating the role of options in underlying security price discovery process.

Price discovery is the process through which market incorporates new information into asset prices and drives it towards new equilibrium price. If information reaches and gets reflected in the options market first, then the traders should be in a position to use this reflection profitably. This proposition attracted researchers' attention towards the information content of options trading with focus on variables such as option prices and non-price variables such as volume of trade, open interest, implied volatility etc.

(for example, see Cao and Ou-Yang 2005, Roll *et al* 2007) and using that information to gain profitably. Lin and Lu (2015) in their study show that predictive ability of options implied volatilities on stock returns increase by more than two times around analysts-related events. Throughout the literature, the importance of both option volume and open interest as lead indicators of equity prices is discussed, but the impact of open interest is more recent. Launois and Van (2003) in the study of takeover announcements, rather than using volume, demonstrate the importance of using open interest as representative of market activity. Schachter (1988) emphasizes that options' open interest, with more sensitivity to volatility changes and having short time to maturity, is able to predict equity returns. Bhuyan and Chaudhury (2005) test the importance of option market's open interest in predicting information about the underlying asset future prices and find that the trading strategies that are based on open interest generate better results as compared to the buy-and-hold and passive covered call strategies. Further, Bhuyan and Yan (2002) develop several price predictors from the option market open interest and volumes of individual stocks and conclude that these predictors contain significant explanatory and predictive power for the future stock prices. Bhuyan (2010) also claim that net open interest of call options and put options together provide a better indication of the future stock price movement. Testing the same proposition in context of Indian equity market, Srivastava (2004) finds that option open interest gives better results in predicting equity prices than option volume. Chan *et al* (2015) test the informational content of options trading on acquirer announcement returns and demonstrate the relevance of options trading volume to predict higher absolute cumulative abnormal returns. These results have been the driving force for this research to study in Indian context the role of option market's open interest in predicting the underlying share prices.

Review of literature

A number of authors studied the role of option market in impounding information into security prices. Apart from price to price relationship between the options market and spot market, a remarkable range of studies have been conducted to identify this linkage using non-price variables of options market such as volume, open interest and number of transactions. Anthony (1988) investigated the relation between common stock volume and call option trading volumes for 25 American firms using pair-wise Granger Causality test. The study hypothesized and tested the sequential flow of information between the stock and option markets. The results suggested that trading in call options leads trading in the underlying shares, with a day's lag.Stephen and Whaley (1990) taking trading volume and number of transactions alternatively as a measure of trading activity, used lead-lag regression where options market activity is regressed against lead and lag terms of spot market activity. The study reported that trading in call options lags trading in underlying.Easley *et al* (1998) investigated the informational links between options markets and equity markets. The main empirical result was that particular negative and positive option volumes contain information about future stock prices. This result was strongly consistent with the hypothesis of option markets being a venue for information-based trading. Srivastava (2003), and Mukherjee and Mishra (2004) examined the relevance of non-price variables, namely open interest and trading volume of stock option market in predicting the price of underlying shares in cash market. The empirical findings from the study clearly indicated that in Indian context, open interest based predictors are statistically more significant than volume based predictors. Bhuyan and Chaudhury (2005) and Bhuyan (2010) suggested that net open interest of call options and put options together provide a better indication of the future stock price movement. In these studies, various trigger points were tested using option open interest information. It was evidenced that the trading strategies that were based on open interest generate better results as compared to the buy-and-hold and passive covered call strategies. Chakravarty*et al* (2004) investigated the contribution of option markets to price discovery, using a modification of Hasbrouck's (1995) "information share" approach. Based on five years of stock and options data for 60 firms, the study estimated the option market's contribution to price discovery to be about 17% on average. Option market price discovery had been related to trading volume and spreads in

both markets and stock volatility. Their results stood consistent with theoretical arguments that informed investors trade in both stock and option markets, suggesting an important informational role for options. Ni *et al* (2005) showed that option trading causes change in the prices of underlying stock. They provided evidence that the strike prices of options cluster at closing prices of optioned stocks. Cao and Ou-Yang (2005) showed that open interest in options affect the trades of the underlying stock. They showed that around the dates of public announcements, the open interest and trading volumes in options are higher. Fodor (2011) also contributed to the literature associating equity markets and option market information. He particularly examined the interaction of change in option open-interest and future underlying equity returns. The study hypothesized that when traders believe that underlying assets will perform well in the near future, they demand relatively more (fewer) call (put) options. On the other hand, if an underlying asset is likely to perform poorly in the near future, they demand relatively more (fewer) put (call) options. He found evidence that changes in open interest that are coming from changes in demand in option market could predict future equity returns with greater accuracy.Delisle (2012) results indicated that neither short interest nor option open interest contained information about future equity returns. However, after employing the option-to-stock volume ratio (O/S) measure it was found that options traders are informed.Hseih and He (2014) examined the predictability of index option put-call volume for the Taiwan markets' index movements for the next day. The study reported the highest predictive ability for foreign institutional investors. High predictive ability for foreign institutional investors was observed on days with important macro-economic news. These traders using limit orders and medium-sized orders tend to exploit these informational advantages for receiving significant trading gains.

It can be seen that a remarkable range of studies examined the role of option volume and open interest in determining underlying equity returns. Some of them gave more importance to option volume in predicting equity returns and others considered open interest to be a determining factor for underlying asset prices. If proposition of any information reflecting in option prices earlier than underlying asset price, holds good for Indian Market too, then it remains to be seen whether the investors can profitably gain from reflections of this information in the options market.

METHODOLOGY

Financial markets are not complete and information related imperfections remain. At any time, agents with positive information about the underlying asset will prefer to establish long positions on out-of-the money (OTM) calls (and not ITM calls) or short positions on in-the-money (ITM) put options (and not OTM puts). More favourable the information, the distribution of their positions will shift to higher strike prices (deep OTM calls or ITM puts). Exactly opposite is expected from those with negative information about the underlying asset. This results in a distribution of open interest over various strike prices of call and put options and keeps changing as more information absorbs into the system. Therefore, in accordance with Aggarwal (2010) and Bhuyan*et al* (2010), using daily closing prices and closing open interests, this distribution of open interests, over different strike prices, is used to construct an open interest based price predictor (OIBPP). In order to check for predictive relationship between OIBPP and respective index prices and the direction of information flow, Granger (1969) Causality test and regression analysis have been carried out. The relationship is further analyzed with introduction of two extraneous variables namely, volatility index (India VIX) and MIBOR rates.

Based on the OIBPP, a trading strategy, namely dynamic (as in Bhuyan*et al* 2010) where trading positions are changed with change in OIBPP, is executed and their risk and return characteristics are analyzed with respect to a passive buy and hold strategy. As options with maturities of one, two and three months are available, the OIBPP is developed for one month maturity for volume and liquidity reasons. Here, an option month is defined as the period between two option expiration dates (Bhuyan and Chaudhury 2001). The study is carried out using statistics for the index Bank Nifty on which options are available in the derivatives segment of NSE. Daily closing data for call and put options (options' closing price and open interest by strike price) is collected from the official website of NSE (www.nseindia.com)

for a period spanning 72 option months from January 2011 to December 2016. Since index trading is not allowed on exchanges, exchange traded fund (ETF) Bank BeEs are used for implementation of trading strategy. This study derives its genesis largely from the work of Bhuyan*et al* (2010) and Aggarwal (2010); the terms and methodology used are also similar to a large extent and explained below.

For call and put options available against a index, define the following as:

t: time

T: Time to maturity

T_0 : Current time

S_t : Stock price at time t

X_i^c : Strike price for call option (i = 1, 2, …,k)

X_j^p : Strike price for put option (j = 1, 2, …,k)

O_{it}^c : Open interest of a call option with strike price X_i at time t

O_{jt}^p : Open interest of a put option with strike price X_j at time t

At any time, t, an equity option open interest based stock price predictor, OIBPP , for maturity of the call and put options (time = T), is defined as follows:

OIBPP $= [\Sigma O_{it}^c X_i^c + \Sigma O_{jt}^p X_j^p] / \Sigma [O_{it}^c + \Sigma O_{jt}^p]$

t$\in [T_o$, T]

For the purpose of scientific analysis, the dataset has been separated into an in-sample analysis period and an out-of-sample analysis period. As there are six years of data, the in-sample period has been selected to be the first three years, 2011-2013. The out-of-sample period then became the last three years of the dataset, 2014 – 2016. It is worth noting that the first three years of the dataset fall under a very different political and economic environment than the last three years. Thus, it is of interest to compare the results of these two distinct time periods.

Establishing the statistical relationship:

Granger [1969] causality tests can be used to determine if there is a short-term predictability of one series to the other. The Granger test is performed to uncover if information moves from the OIBPP series to the index data. Then, regression analysis is performed in order to develop an understanding of the relationship between the Open Interested Based Predictor (OIBPP) and the index that is Nifty Bank index price. Each data series has been transformed to ensure that each series is stationary. The Nifty Bank index closing prices series and OIBPP data series require a transformation via the natural logarithm in order to convert the variance to stationary. Mean stationarity is then achieved by taking the first difference of each log transformed series. The result has been confirmed with a standard augmented Dickey-Fuller [1979] unit root test.

In order to perform the Regression analysis, an autoregressive lagged model is applied which incorporates the lags of both the dependent variable and the independent variable, as follows:

$\Delta \ln(NiftyBank)\,t = \emptyset + \sum_{i=1}^{n} \omega_i \Delta \ln(NiftyBank)_{t-i} + \sum_{j=1}^{n} \partial_j \Delta \ln(OIBPP)_{t-j} + \varepsilon_t$ (1)

Number of lags of dependent and independent variable to be included in the model has been determined with least Akaike Information criterion(Akaike, 1974). The lagged model in equation (1) has been further tested with control variables for the volatility index (VIX) and the Mumbai Inter-Bank Offer rate (MIBOR) as follows:

$\Delta \ln(Niftybank)\,t =$

$\emptyset + \sum_{i=1}^{n} \omega_i \Delta \ln(NiftyBank)_{t-i} + \sum_{j=1}^{n} \partial_j \Delta \ln(OIBPP)_{t-j} +$

$\sum_{k=1}^{n} \gamma_k \Delta \ln(VIX)_{t-k} + \sum_{l=1}^{n} \beta_l \Delta \ln(MIBOR)_{t-l} + \varepsilon_t$ (2)

The VIX data series after transformation to a first differenced log series has turned to mean and variance stationary. MIBOR data series has shown mean and variance stationarity after transformation to a series of first differenced data.

Though the OIBPP variable displays predictive power on the Nifty Bank index on its own, the usefulness of the OIBPP value as a trading indicator may be much more practical if it is used relative to a reference point or in a scaled form. In this direction a more useful trading indicator, the ratio of OIBPP to the Nifty Bank index has been calculated. The assumption is that in a ratio of OIBPP to the index value, a change in one variable may become more obvious when scaled against the other variable. The above regression analysis has been repeated to establish the relationship between the ratio data and the index data. The ratio data series has become mean and variance stationary after transformation to a series of first differenced data as below:

$$\Delta \ln(Niftybank)\, t = \emptyset + \sum_{j=1}^{n} \partial_j \Delta \ln(Ratio)_{t-j} + \varepsilon_t \qquad (3)$$

In order to test the economic significance of the OIBPP ratio indicator, a trading strategy has been developed. Given the regression results, it appears that a short-term movement of the OIBPP ratio indicator predicts a short-term movement in the same direction for the Nifty Bank index.

Based on Bhuyan (2010), a simple trading strategy using the ratio indicator could evolve around the following: buy shares in the index when the indicator predicts an increase in the index and sell (or short sell) the index when the indicator predicts a decrease in the index. When a "strong buy" indicator is given, a leveraged amount of shares may be purchased. During a strong bull market, buying a leveraged amount of shares would allow the strategy the opportunity to potentially outperform a buy-and-hold strategy, provided the OIBPP ratio indicator is correct. These types of trades could be easily executed with Bank BeEs, which track the Nifty Bank index.

The details of the strategy that has been used in the base case include the following: Start off in a cash position. When a "buy" indicator occurs, the investor buys 100 BeEs, that is a 100% equity position. If another "buy" indicator occurs during a current long position, this is interpreted as a "strong buy" and the investor leverages to a position of 200% equity (Purchase of 100 more BeEs). For simplicity, if another "buy" indicator occurs while holding the 200% equity position, that "buy" indicator is ignored rather than taking on more leverage. If instead, a "sell" indicator occurs, the investor reduces to a 100% equity position (Sell off 100 BeEs). If another "sell" indicator occurs, the investor sells off to a 0% equity position or an all cash position (sale of 100 more BeEs). If another "sell" indicator occurs, the investor takes a short position equal to an equity position of -100% (or short 100 bees). For simplicity, if another "sell" indicator occurs while holding a short position, that "sell" indicator is ignored rather than shorting more bees. If instead, a "buy" indicator occurs, the investor covers the short position and resumes the all cash position and so forth. Therefore, "buy" and "sell" indicators tell the investor when to change between one of four positions, either -100%, 0%, 100%, or 200% equity.

In order to decide when to trade, trigger points are chosen for indications of when to trade: i.e. "buy" or "sell".One method to calculate trigger points is to use specific distances or deviations from the average value of ratio indicator which turned out to be 1.00. For example, if a buy-sell indicator deviation of 10% is selected as a trigger point, then the resulting indicators would be 10% above the average and 10% below the average. Thus, a "buy" indicator would result for the following day for any ratio value above 1.10on the previous day and a "sell" indicator would result for the following day for any ratio value below 0.90 on the previous day. For any ratio value from 0.90 to 1.10, the investor would "hold" the current position.

In order to examine the effect of various possible indicator trigger points on strategy performance, a range of trigger points have been tested and the resulting strategy returns have been recorded for the in-sample period of 2011 to 2013. A standard active management performance measure, the active return, is used to test the effectiveness of the trading strategy; the active return is calculated as the difference between the active strategy return and buy-and-hold return.

Out-of-sample testing of the trading strategy:

The same trading strategy that has been developed and calibrated for the in-sample period has been tested on the out-of-sample period of 2014 to 2016. Using the same buy-sell indicators that have been calibrated from the in-sample period, the trading strategy results for the out-of-sample period are displayed in Results section. Routine descriptive and inferential statistics have been computed for results.

FINDINGS

In dynamic strategy, positions once established change with change in open interest based price predictor. Sample period (2011-2016) has been divided into two periods i.e. in-sample-period (2011-2013) and out-of-sample period (2014-2016). First, Granger causality test has been applied to check the predictive relationship between open interest based price predictor (OIBPP) and the index closing price. This test can uncover how information moves from the OIBPP series to index closing prices and vice-versa.

Option expiry- 1 month

Granger causality test null hypothesis: "The OIBPP does not Granger cause the Nifty Bank index closing price"

Test Statistic   = 8.69
 p   = 0.0130

The Granger causality test statistic 8.69 (p = 0.013) implies that open interest based price predictor (OIBPP) Granger causes the Nifty Bank index closing prices implying that information in OIBPP (option expiry 1 month) data can be used to predict short-term movements of the Nifty Bank index closing price.

For the in-sample period (2011-13), taking open interest based predictor (OIBPP) as independent variable and underlying index prices as dependent variable, regression analysis has been carried out. The results for the same are presented in table 1. **Table 1: Results for autoregressive model between Nifty Bank index and Open interest based predictor (OIBPP) for one month option expiry**

Variable	estimate	P-value
Ø Constant	0.979	0.000
Nifty Bank (-1)	0.372	0.128
OIBPP (-1)	0.894	0.023
R-square	0.685	
Adjusted R-squared	0.684	
F-statistic	60.160	
Prob (F-statistic)	0.000	
Akaike info criterion	2.854	

As shown, in the regression model, both constant (Ø = 0.979, p = 0.000) and lagged OIBPP coefficient (0.894, p = 0.000) are statistically significant. But estimate of lagged Nifty Bank (0.372, p = 0.128) has been found to be insignificant. Given that coefficient of OIBPP is significant and positive, it appears that there is predictive relationship between OIBPP and index data in the same direction. Coefficient of determination that is R-square has been found out to be 68.53% which signifies that approx 68% of the variations in Nifty Bank index closing prices are explained by fitted regression model. Value of F- statistics at 60.160 (p = 0.000) suggests that model is good fit.

The autoregressive model in equation (1) when tested with addition of two control variables for volatility index (VIX) and Mumbai inter bank offer rate (MIBOR) to control for volatility in the market and the effect of interest rates produced the following results as shown in the table 2.

Table 2: Results for autoregressive model between Nifty bank index, OIBPP, VIX and MIBOR for one moth option expiry

Variable	estimate	P-value
Ø	4.571	0.000
Nifty Bank (-1)	0.383	0.472
OIBPP(-1)	0.584	0.004
VIX(-1)	-0.174	0.283
MIBOR(-1)	-0.092	0.399
OIBPP (-1)	0.894	0.023
R-square	0.776	
Adjusted R-squared	0.678	
F-statistic	81.555	
Prob (F-statistic)	0.000	
Akaike info criterion	-2.189	

Constant (Ø = 4.571, p = 0.000) and estimate of lagged OIBPP (0.584, p = 0.000) have been found to be statistically significant. But estimates of lagged Nifty Bank (0.383, p = 0.472), lagged Volatility index (-0.174, p = 0.283) and lagged Mumbai inter-bank offer rate (-0.092, p = 0.399) have been observed to be insignificant. As shown, the addition of these two control variables serves to strengthen the significance of lagged OIBPP coefficient. This suggests the independence of OIBPP. Probability of overall model (F stats = 81.555, p value = 0.000) has been observed to be statistically significant. The value of adjusted R-squared is less than the previous model adjusted R-squared using OIBPP alone as independent variable. It shows that there is no increase in the explanatory power of regression model with the addition of VIX and MIBOR as independent variables.

The regression analysis performed using ratio of OIBPP to Index closing price (Ratio) as independent variable has produced the results as shown in the table 3.

Table 3: Results for regression model between Nifty bank index and Ratio (OIBPP to nifty bank index closing price) for one month options expiry

Variable	estimate	P-value
Ø	9.275	0.000
RATIO (-1)	0.751	0.000
R-square	0.704	
Adjusted R-squared	0.697	
F-statistic	66.361	
Prob (F-statistic)	0.000	
Akaike info criterion	-1-882	

Results show that estimate of Ratio (OIBPP/index closing price) 0.751 is statistically significant (p = 0.000). Value of adjusted R-squared has also improved when compared to the model using only OIBPP as independent variable. It implies that variations in index closing price are better explained using ratio of OIBPP to index closing price. Overall model using ratio as independent variable has been found to be statistically significant (F stats = 66.361, p = 0.000).

Calibration of dynamic trading strategy:

Findings from the regression analysis suggest that a short-term movement of the OIBPP ratio indicator predicts a short-term movement in the same direction for the Bank Nifty with a one day lag. Now, in order to test the economic significance of the OIBPP ratio indicator, a trading strategy as discussed in methodology section is implemented. A simple trading strategy using the ratio indicator (OIBPP) could evolve around the following: buy the shares in index when the indicator predicts an increase in the index and sell (or short sell) the index when the indicator predicts a decrease in the index.

Further, in order to examine the effect of various possible indicator values on strategy performance, a range of indicator values have been tested and the resulting returns have been recorded for the in-sample period of 2011 to 2013. A standard active management performance measure, the active return, has been used to test the effectiveness of the trading strategy. The active return is calculated as the difference between the active (dynamic) strategy return and buy-and-hold return. In the in-the-sample period, various trigger points have been tested and results of the same are displayed in this section.

Figure 1 presents the analysis of buy-sell trigger points during the in-sample period (2011-13) for Nifty Bank index and one month option expiry. The buy/sell deviation range of 2% to 19% gives positive active return. In other words, it suggest that using a buy-sell deviation of less than 2% would lead to unnecessary trading on weak information and that using a buy-sell deviation of more than 19% would lead to missed trading opportunities on valuable information. At the buy-sell deviation trigger of 15%, the highest level of performance occurs (i.e. a buy indicator when the ratio is above 1.15 and a sell indicator when the ratio is below 0.85). Coincidentally, 15% is three standard deviations; as depicted in summary statistics. The average number of portfolio rebalances required decreases with the increase in buy/sell deviation trigger point. This strategy trial requires an average of only 6 rebalances per year. Transaction costs should not be a concern with such a small number of trades per year.

Fig 1 Analysis of buy-sell trigger point in the in-sample period (2011-13) for Nifty Bank index and one month option expiry
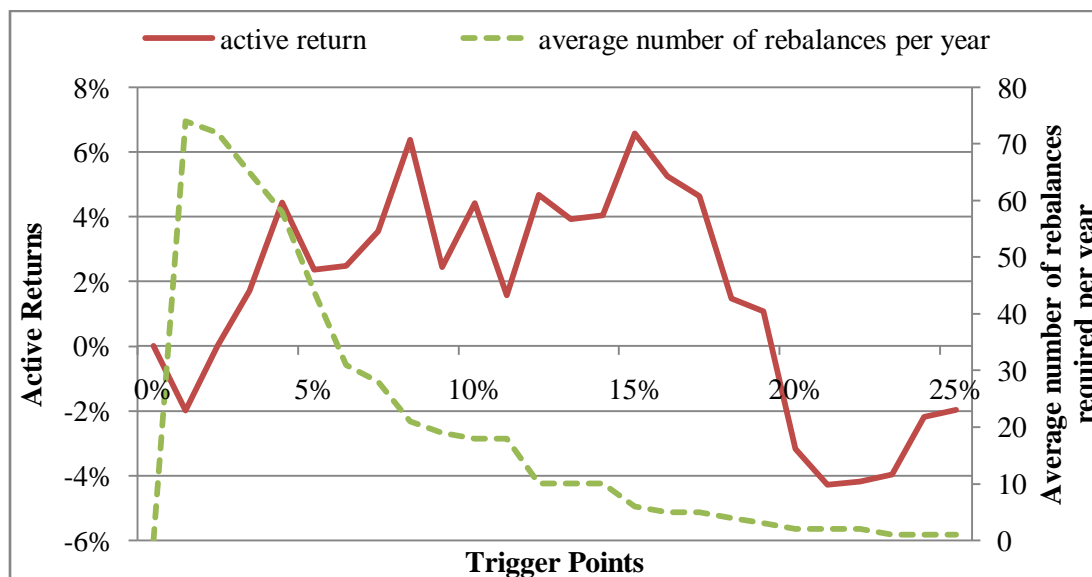
Out-of-sample testing of the trading strategy:

The trading strategy that has been developed and calibrated for the in-sample period, has been applied on the out-of-sample period of 2014 to 2016. This section of the study presents the the results for the same. Year-by-year geometric average returns for the buy-and-hold trading strategy and the OIBPP indicator based trading strategy have been shown. Active return is calculated as the difference between the dynamic strategy return and the buy-and-hold return. Values for the three-year period have been annualized. Monthly returns have been used to calculate arithmetic return and standard deviation. Information ratio has been used as the criteria for performance evaluation.

Table 4 presents the trading strategy performance analysis during out-of-sample period (2014-16) for Nifty Bank index and option expiry of one month. As shown in the table, for the out of sample period of 1st Jan, 2014 to 31st Dec, 2016, dynamic trading strategy has outperformed the buy-and-hold strategy during all three years. Using a buy-sell deviation indicator of 15% (calibrated from in-sample period) leads to an annualized arithmetic active return for the 3 years out-of-sample period of 10.44% per year with an information ratio of 0.79. According to Gastineau *et al* (2007), an information ratio of 0.50 is expected of first-quartile active portfolio managers. The strategy thus performs equivalent to at least second-quartile active portfolio managers. The results are far better than even the in-sample results of active return of 6.57% and information ratio of 0.68. The strategy requires an average 4.5 rebalances per year during this period. Once again, transaction cost should be of little concern for such minimal trading activity.

Table 4   Trading strategy performance analysis in out-of-Sample Period (2014-16) for Nifty Bank index and option expiry of one month

Time Period	OIBPP based strategy return (A)	Buy-and-hold strategy return (B)	Active Return (A-B)
1/1/2014 – 12/31/2014	8.64%	5.55%	3.09%
1/1/2015 – 12/31/2015	17.62%	14.90%	2.72%
1/1/2016 – 12/31/2016	27.47%	1.96%	25.51%
Overall results (1/1/2014 –12/31/2016)			
Geometric mean	16.11%	5.45%	5.98%
Arithmetic mean	17.91%	7.47%	10.44%
Standard Deviation	9.41%	6.68%	13.05%
Information Ratio			0.79

CONCLUSION

In this study it has been found that equity options open interest contains valuable information that is attractive for trading purposes. The results show that average returns from active strategies based upon options' open interest are significantly higher than passive buy and hold strategy returns. The active portfolio strategy largely outperforms the passive buy-and-hold during the sample period of 2011-2016.

Therefore, assumption of private information being reflected in option market before the spot market stand good for Indian equity market too.

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A STUDY OF PERFORMANCE APPRAISALS PRACTICES IN JSW STEELS PVT LTD. TORANAGALLU

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ABSTRACT

 Performance Appraisal has been considered as the most significant an indispensable tool for an organization, for an organization, for the information it provides is highly useful in making decisions regarding various personnel aspects such as promotion and merit increases. Performance measures also link information gathering and decision making processes which provide a basis for judging the effectiveness of personnel sub-divisions such as recruiting, selection, training and compensation. This research will concentrate on examine the effect of the performance appraisal on an individual as well as on the organizations. The selected organization for study isJSW STEELS PVT LTD. TORANAGALLU. The sample size of 100 has been chosen randomly from the organization . The data used for the study is primary data collected through the help of questionnaire filled by the samples. The study revealed that the organization use 360 Degree Appraisal method for performance appraisal. Furthermore, it was again revealed that employees are satisfied with the current appraisal method and agreed that performance appraisal helps in achieving organization goals, helps in improving motivation & job satisfaction and employees performance.

Keywords: Performance Appraisal, Recruiting, Selection, Training, Compensation ,Organization, Individual, Motivation, Job Satisfaction.

1. INTRODUCTION OF THE STUDY

 Performance appraisal is the process of obtaining, analyzing, and recording information about the relative worth of an employee to the organization. Performance appraisal is an analysis of an employee's recent successes and failures, personal strengths and weaknesses, and suitability for promotion or further training. It is also the judgment of an employee's performance in a job based on considerations other than productivity alone. Performance' appraisal is a formal structured system of measuring and evaluating an employee's job related behaviors and outcomes to discover how and why the employee is presently performing on the job and how the employee can perform more effectively in the future so that the employee organization and society all benefit. Performance Appraisal has been considered as the most significant an indispensable tool for an organization, for an organization, for the information it provides is highly useful in making decisions regarding various personnel aspects such as promotion and merit increases. Performance measures also link information gathering and decision making processes which provide a basis for judging the effectiveness of personnel sub-divisions such as recruiting, selection, training and compensation. Accurate information plays a vital role in the organization as a whole. They help in finding out the weaknesses in the primary areas.

2. ADVANTAGES OF PERFORMANCE APPRAISAL

Promotion: Performance Appraisal helps the supervisors to chalk out the promotion program's for efficient employees. In this regards, inefficient workers can be dismissed or demoted in case.

Compensation: Performance Appraisal helps in chalking out compensation packages for employees. Merit rating is possible through performance appraisal. Performance Appraisal tries to give worth to a performance. Compensation packages which include bonus, high salary rates, extra benefits, allowances and pre-requisites are dependent on performance appraisal. The criteria should be merit rather than seniority.

Employees Development: The systematic procedure of performance appraisal helps the supervisors to frame training policies and programs. It helps to analyze strengths and weaknesses of employees so that new jobs can be designed for efficient employees. It also helps in framing future development programs.

Selection Validation: Performance Appraisal helps the supervisors to understand the validity and importance of the selection procedure. The supervisors come to know the validity and thereby the strengths and weaknesses of selection procedure. Future changes in selection methods can be made in this regard.

Communication: For an organization, effective communication between employees and employers is very important. Through performance appraisal, communication can be sought for in the following ways:

• Through performance appraisal, the employers can understand and accept skills of subordinates.

• The subordinates can also understand and create a trust and confidence in superiors.

• It also helps in maintaining cordial and congenial labor management relationship.

• It develops the spirit of work and boosts the morale of employees. All the above factors ensure effective communication.

Motivation: Performance appraisal serves as a motivation tool. Through evaluating performance of employees, a person's efficiency can be determined if the targets are achieved. This very well motivates a person for better job and helps him to improve his performance in the future.

3. METHODS OF PERFORMANCE APPRAISAL

There are two types of measures are used in performance appraisal: Objective measures which are directly quantifiable and Subjective measures which are not directly quantifiable. Performance Appraisal can be broadly classified into two categories: Traditional Methods and Modern Methods. The performance appraisal methods are:

1. Traditional Method

2. Modern Method

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                    │   Methods of Performance Appraisal    │
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    │                 │          │                 │
    │ Traditional     │          │  Modern         │
    │ Methods         │          │  Methods        │
    │                 │          │                 │
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Traditional Methods	Modern Methods
1. Rate scaling 2. Check list 3. Forced choice method 4. Forced distribution 5. Critical incidental 6. Field review 7. Performance test 8. Performance ranking 9. Comparative evaluation 10. Confidential records	1. Management by objectives 2. Assessment centers 3. 360 degree appraisal method 4. 720 degree appraisal method 5. Psychological appraisal method

4. REVIEW OF LITRATURE

Eichel and Bender (1984) reveals performance evaluations were designed primarily as tools for the organization to use in controlling employees. He states that past performance was used to guide or justify manager His method of appraisal was subjective, which is still common with EPAS in many agencies today

Levinson (1992) conceals that to help the development of the process of identification it is necessary for the manager to also examine his own process and needs of interacting with the subordinates. He also states several barriers which may come in the way of such legitimate process of identification as; lack of time, intolerance, of mistakes, complete rejection of dependency needs repression of rivalry, and unexamined relationship.

Mbiti (1994) uncover employee into four major vegetations and rejecters. Mbiti describes vegetations as people who care for nothing except their pay at the end of the month. They have no initiative; they will take the slightest excuse to be off duty; because this gives them pleasures

than writing. They require constant supervision without appraising them; they will try to hide amongst others while they do nothing. it reveals that design an acceptable, easy-to-use but reliable appraisal instrument that helps in improvement and employees development.

Davis (1995), finds that If employees are effectively appraised, then the organization will experience increased productivity and improved quality of output and for effective development and utilization of the human talent, performance appraisal plays a key role as it enables an organization to identify objectively the employee's strengths and weaknesses.

Edwards &Ewin, (1996) reveals that feedback from multiple sources, such as superiors, peers, subordinates and others has a more powerful impact on people than information from a single source, such as their immediate supervisor. Employees view performance information from multiple sources as fair, accurate, credible and motivating. They are more likely to be motivated to change their work habits to obtain the esteem of their co-workers than the respect of their supervisors.

Richi (1996) disclose that the skill-based management measures skill and tracks and combines them into job that creates a work environment that allows employees to develop the skills they need to meet business goals descriptions, identifies employee skills gaps and then provides resources to upgrade abilities.

Quchi(1997) uncover that get policies and procedures manuals and train the entire organization on target setting, monitoring and review.

(Wagner and Goffin 1997) unearth "that the comparative rating method was more accurate than the absolute rating method and that the global item type results in considerably greater accuracy with respect to [differential accuracy] and [stereotype accuracy] components but specific items were more advantageous in terms of [differential elevation] and [elevation] accuracy" (p. 99). The results of this experiment suggest that comparing employees against one another will yield a more accurate depiction of ones work than rating employees against a set of standards.

Strebler, (1997; Akinyele and Obamiro 2005). Uncover the development of integrated performance management system (PMS) based on a competency framework.

Makiney and Levy (1998) gathered a group of volunteers, 120, all of whom have participated in performance reviews in the past. The volunteers were given work habits of employees at a bookstore and were then told to create an initial judgment on the employee in question The results of the experiment were not unexpected. "Negatively discrepant information elicited significantly lower ratings than did positively discrepant information" and "that the additional information more strongly influenced performance judgments when the additional information was provided by the peer of the profiled employee, than when the additional information was provided by the profiled employee himself".

Cascio (1998) disclose, it is an inexact, human process that is utilized differently in almost every organization regardless of industry.

Moulder (2001) Moulder reveals that appraisals are useful insetting goals and in fostering improved communications among work groups and between employees and supervisors. This study predicts that performance appraisals are valued for defining expectations and measuring

the extent to which expectations are met. It states state that appraisals can make clear to employees where they are having success and where they need to improve performance.

Armstrong (2001) conceals that performance management provides an integrated and continuous approach to the management of performance thanis provided by traditional performance appraisal schemes. Unlike traditional methods of management by command, performance management is based on the principle of management by agreement.

Armstrong (2001) postulates that performance management can provide for an integrated and coherent range of human resource management processes that are mutually supportive and contribute as a whole to increasing organizational effectiveness.

5.RESEARCH METHODOLOGY

OBJECTIVES OF THE STUDY

• To find out the effectiveness of performance appraisal used by the organizations on the performance of the organization.

 • To find out the effect of the performance appraisal on the employees.

• To critically evaluate the techniques used by the organizations for the purpose of performance evaluation.

DATA SOURCE AND TYPE

 The study is mainly based on primary data. The required data has been collected from the response of the selected samples of organization

SAMPLE SIZE AND SAMPLING TECHNIQUE

In this study the target sample size was 100 respondents from JSW STEELS PVT LTD. TORANAGALLU . Simple random sampling technique was used for the purpose of selecting the respondents. Data Collection and Tools for Analysis A simple Questionnaire consisting 12 questions are framed for the purpose of collection of data. The collected data were tabulated for the purpose of analysis. Data is analyzed in percentages.

6.DATA ANALYSIS AND INTERPRETATION.

The survey included respondents from different age groups. The table below shows the classification of the age groups and gender of the respondents.

Table 1. Profile of the Respondents

Particulars	Category	Frequency	Percentage
Gender	Male	54	54%
	female	46	46%
Age group	Below 30	30	30%
	30-39	42	42%
	40-49	22	22%
	Above 50	6	6%

Source: Field survey

Above table shows that male employees are more than female employees and most of the employee's respondents are of the age group 30-39.

Table 2. Current Appraisals Methods Used

Performance Appraisal	Frequency	Percentage
360 Degree Appraisal Method	31	31%
Management By Objectives	26	26%
Rating Scale	23	23%
Checklist	20	20%
720 Degree Appraisal Method	0	0%

Source: Field survey

Table 2 indicates that the organization uses 360 Degree Appraisal Method and Management by Objectives (26%). Only 20% the organization use Checklist method for performance appraisal of employees. 720 Degree Performance Appraisal method is not used in the selected organization.

Table 3. Employee Opinions about Performance Appraisal.

Employee Opinions	Frequency	Percentage
Evaluation of Employees	43	43%
Promotion of Employees	23	23%
Job Satisfaction of Employees	20	20%
Motivation	14	14%

Source: Field survey

From the above table we understand that 43% employees opinion that performance appraisal is the evaluation of employees, 23% employees opinion that performance appraisal is the promotion of employees, 20% employees opinion that performance appraisal is job satisfaction of employees and only 14% employees opinion that performance appraisal is the motivation of the employees.

Table 4. Current Status of Performance Appraisal

Dimension	Yes	No
Increment in salary after Performance Appraisal	54	46
Helps in achieving goals	90	10
Improve employees performance	86	14
Improve motivation and job satisfaction	90	10
Helps to change employees behavior	86	14
Encouraged to share one another burden	75	25

Source: Field survey

Table 4 indicates that most of the employees are happy with the current appraisal method. Most of the employees stated that performance appraisal helps in achieving goals, helps to improve employee's performance, employee's motivation & job satisfaction and helps to change employee's behavior.

Table 5. Satisfied – Current Appraisal Method.

Option	Values	Percentage
Yes	72	72%
No	28	28%

Source: Field survey

Table 5 reveals that 72% of the employees stated that they were satisfied with the current appraisal method only 28% employees showed their dissatisfaction with the current appraisal method.

Table 6. Influence from Top Level Management Biasness.

Option	Values	Percentage
Yes	24	24%
No	76	76%

Source: Field survey

Table 6 shows that most of the employees stated that their appraisal is not influenced by top level management biasness only 24% employees agreed that their appraisal is influenced by biasness of top level management

CONCLUSION

The common answer about the need for appraisal is that the appraisal process is necessary. The most important purpose of appraisal is to improve the performance in future. From the above study it is clear that most of the selected banks use 360 Degree Appraisal Method. 720 Degree Appraisal method is not used by the selected private banks. From the study it has been clear that most of the respondents are happy with the current appraisal method. From the above sample study it is clear that most of the employees are satisfied with the current appraisal method and agreed that performance appraisal helps in improving performance, achieving organization goals, helps in increasing motivation and satisfaction. Finally this study found that employees are satisfied from current appraisal method and most of the employees stated that their appraisal is not influenced by biasness of top level management. Performance Appraisal is often the central pillar of performance management in the bank to keep the motivation of the employees high.

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"EMOTIONAL INTELLIGENCE AND JOB SATISFACTION AMONG THE BANK EMPLOYEES IN   MORADABAD CITY"

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Abstract

Background: Emotional intelligence and Job satisfaction are two concepts of high interest in the modern work environment. They serve as a competitive edge in personal and organizational life. However, there are only few studies that explore the factors which affect the two concepts.

Purpose: The primary aim of this study is to examine the relationship between emotional intelligence and job satisfaction.

Findings: The study reveals that there is a very high positive relationship between Emotional Intelligence and Job Satisfaction.

INTRODUCTION

EMOTIONAL INTELLIGENCE

Emotional intelligence (EI) is the capability to monitor one's own and other people's emotions, to distinguish between different emotions … and to use emotional information to guide thinking and behavior." EI is an excellence that is being increasingly valued in organizations around the world. The reasons are not difficult to identify with. An alertness and understanding of our own emotions lets us be familiar with the same in the others. It forms the basis of empathy, which is a vital trait in a leader, a manager, or an employee. It's not sufficient to be well-informed, knowledgeable smart, or intelligent. If you cannot meet people where they are, you will not be able to move up them to the level you want them to rise to. Luckily, all of us can develop our EI. Those people who are weak in emotional intelligence they can work on it to improve.

Components of Emotional Intelligence

1- **Self- awareness-** If a person is self-aware about his emotions and his actions it can affect the people around him. Being self-aware also means having a clear picture of own strengths and weaknesses.
2- **Self-regulation-** Self-regulation is a very important component of emotional intelligence. Self-regulation helps a person to control him verbally, in his emotional decisions, stereotyping people and compromising his values.
3- **Motivation-** Self-motivation helps the employee work efficiently and effectively and productivity can be enhanced by self-motivation.
4- **Empathy-** Empathy is the ability to understand and share the feelings of another. It is an essential component for an employee for smooth working in an organization.
5- **Social skills-** Employees with social skills are very good communicators. They can easily manage change and resolve conflicts.
6- **Relationship Management**- Relationship management is very much important between a company and its external partners, especially its clients. If an employee is expert in relation management it is good for company.

Emotional intelligence is essential to building an impartial - life

Emotional intelligence is a first step to an impartial - life. It's necessary to basically every phase of life.
Physical Health – The ability to be careful of our bodies and especially to manage our stress, which has an unbelievable impact on our overall wellness, is deeply attached to our emotional intelligence. We can manage stress and maintain good health only by being aware of our emotional situation and our reactions to job stress in our lives.

Mental Well-Being – Emotional intelligence is good for our attitude and viewpoint on life. Anxiety, depression and mood swings can also be reduced by it. A positive attitude and happier outlook on life is directly correlated with emotional intelligence.

Relationships – Those are better able to communicate our feelings in a more positive way by better understanding and managing our emotions. It can help in understanding the feelings and emotions of those who are our closed ones.

Conflict Resolution – If a person is emotionally intelligent it will be easier to him to solve a dispute or a situation easily. These kinds of people are better at negotiations as they can easily understand the needs and wants of others.

Success – Self-confidence can be increased by higher emotional intelligence. Highly emotionally intelligent people are great motivators. Employees can also improve their ability to focus on a goal by emotional intelligence.

Leadership – Those who are highly emotional intelligent can be great leaders. They can easily inspire others. They can easily influence a group of people by their personality and skills.

Emotional intelligence plays an important role in improving quality of our professional and personal lives. In today's high-tech world technology and tools can help us to learn and more and more information but nothing can replace our ability to learn, manage, and master our emotions and the emotions of those around us.

Job Satisfaction

Job satisfaction is defined as the amount to which an **employee** feels vibrant, & **pleased** with his/her **job**. When an **employee** feels he or she is having job stability, career growth and a comfortable **work** life balance then it can be said that he or she is highly job satisfied.

Importance of Job Satisfaction

A satisfied employee is always essential for an organization as he/she aims to deliver the best of their potential. At workplace every employee wants a strong career growth and **work life balance**. If an employee feels happy with their company & work, they look to give back to the company with all their efforts.

The positive effects of job satisfaction include:
1. If employees are satisfied with their job then they can be more efficient at the workplace.
2. More committed and loyal employees.
3. It can result in higher profits for companies.
4. If employees are happy high employee retention is possible.

Job Satisfaction Factors

1. Compensation & Working conditions: Biggest determinants of job satisfaction are compensation and benefits which are given to an employee. A good salary, incentives, bonuses, healthcare options etc. are the factors which are necessary to make an employee happy. A healthy workplace environment is also important for an employee.

2. Work life balance: A good workplace is that which allows its employees to spend time with their family and friends with doing their work , can give an employee extreme job satisfaction. **Quality of employee's work life** can be improved by this.

3. Respect & Recognition: If employees are respected at their workplace they will feel motivated. Awards for the hard work are also good for employee's motivation.

4. Job security: If an employee is confident that the company would retain them even if the market is unstable, it gives them massive confidence. Job security is power ful factors for job satisfaction of employees.

5. Challenges: Repetitive job activities can lead to dis-satisfied employees. Things like job rotation, job enrichment etc will facilitate in job satisfaction of staff in addition.

6. Career Growth: Employees give career growth highest priority in their life. Hence, if an organization helps staff and provides them difficult job roles, it enhances the work satisfaction as they understand they'd get advancement in their career.

REVIEW OF LITERATURE

The term "emotional intelligence" was first used in 1999 by Salovey and Mayer, who have defined emotional intelligence as the ability to recognize, understand and manage emotions both our own and others.

As research progressed and more scholars start dealing with the concept of emotional intelligence, various models, more or less known, were developed. The basic models that developed fall into two categories: the models that consider emotional intelligence as ability (ability EI) which is associated with the ability to control emotions, how to deal with situations/challenges and those who consider emotional intelligence as a characteristic (Trait EI) which is directly associated with the personality traits.

Hopkins & Bilimoria (2008) in his study "Social and Emotional Competencies Predicting Success for Male and Female Executives" explored the relationship between emotional and social intelligence competencies and organizational success. The study illustrates not much of differences between male and female leaders in their demonstration of emotional and social intelligence competencies and also found that when it comes to competency demonstration most successful men and women were more the same than different. However gender did play a reasonable role in the relationship between the demonstration of these competencies and success. 65 Further male leaders were considered to be more successful, even though male and female leaders demonstrated the same level of competencies. The four competencies that divided the most successful male and female leaders from their typical counterparts were Self Confidence, Achievement Orientation, Inspirational Leadership and Change Catalyst.

Goleman (2001) "Working with emotional intelligence" Competency research in over 200 companies and organizations worldwide shows that about one-third of the difference is due to technical skill and cognitive ability while two-thirds is due to emotional competence. (In top leadership positions, over four-fifths of the difference is due to emotional competence).

(LI, Gupta, Loon, & Casimir, 2017) found relationship between emotional intelligence and leadership. The leaders who favor before style i.e. with the cushion of psychological support have the highest levels of emotional intelligence than the one who favors delayed style i.e. leaders who delay in providing support with the pressure. Emotional intelligence can be linked to the style of leadership. The study supports before style leadership which means providing support to the employees along with the pressure and the leader who is emotionally intelligent is in a better position to give that support. They found the effectiveness of leadership in the form of supportive behavior and optimism in terms of emotional intelligence. Which will result in improved performance than the negative impact of frustrations?

(Meisler, 2014) in his study on 368 employees from financial sector found that emotional intelligence has positive association with organizational justice and negative with turnover intentions. For the purpose of the study records of actual turnover was used. (Meisler, 2013) emphasized on emotional intelligence training to improve organizational justice and reduce employee turnover. Organizational justice also mediates EI and turnover intentions. The study thus recommended on the positive impact of EI on employees which helps in reducing their turnover. Thus, an organization should work on developing a training program for the same.

(Nikolaou & Tsaousis, 2004) explored the association between EI and occupational stress' sources and outcomes. For this questionnaire and organizational stress screening tool i.e., ASSET is used. The study revealed a negative correlation between EI and Occupational stress which means higher the level of EI lower the level of stress at work. The study also found positive association between EI and organizational commitment. The study favored emotional intelligence as an effective tool as there is a strong linkage among EI, occupational stress and employee commitment.

(Pradhan & Kesari, 2018) studied the effect of abusive supervision and subordinates' intention to quit and role of emotional intelligence in neutralizing and curbing the effect. The study collected the data at two-time points. At first point subordinates' perception on their supervisor's abusive behavior is analyzed and in the 2nd point analysis is made on their intentions to quit and emotional intelligence. 353 professionals from health care working in Indian hospitals had been interviewed for the same. The study found a strong relationship between emotional intelligence and intention to quit and abusive supervision and also concluded in a moderating effect of emotional intelligence on it i.e. higher the emotional intelligence lower is the intention to quit. The study further recommended in imparting proper emotional intelligence training to the people in organization so that behaviors like abusive supervision can be reduced and at the same time tolerance for the same can be increased.

Emotional Intelligence and Job Satisfaction

Various studies have been conducted on emotional Intelligence and its importance in organizations. Few of them, which were in line with the current study have been summarized as under: As per Weinberger (2009), the concept of emotional intelligence has been developed over time as a complimentary intelligence to intellect and social intelligence, among others. The research has evolved over time, and spans mid-century work in behavioural science to more recent works focusing specifically on the study of emotional intelligence (Weinberger, 2009) . (Wechsler, 1959). As researchers have looked to develop the study of emotional intelligence, the study has branched into three general models. He attempted to bucket the definitions and models of EI into three categories: Ability Model, Personality Model, and a Mixed Model. The "Ability Model" implies that EI is a competency that can be learned, developed and maintained as individuals focus on the elements of the paradigm of EI (Muyia, 2009). Job satisfaction is the most critical element present in organization. If employees are satisfied from the job and job duties then they can perform in the effective and efficient way (Bull, 2006). He suggested that the job satisfaction is an affective or emotional response towards individual's job and various which are related to individuals work (Schermerhorn, 1994).

Objectives

1- To study about emotional intelligence and job satisfaction among employees.

2- To study the relationship between emotional intelligence and job satisfaction.

RESEARCH METHODOLOGY

Research is a systematic investigation resulting in some formal record of procedures and the report of procedures and the report of conclusion and results. Research has been defined as "a formal systematic method of analysis"

[1]   **Data collection:** The study on emotional intelligence on job satisfaction among the banks" is a descriptive research. The method adopted in the study is questionnaire method.

[2]   **Sampling:** the study on sample size of 60 from banks through convenient random sampling was used.

[3]   **Statistical tool use:** Mean score and correlation analysis is used for statistical analysis.

Data Analysis

Emotional Intelligence Factors
Table 1.1: Collective Percentage Level of Emotional Intelligence Factors

Sr. No.	Factors of Emotional Intelligence	No. of Respondents Answered	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
			1	2	3	4	5
1	Self-Awareness	60	8.33	6.67	20	31.67	33.33
2	Self-Regulation	60	11.67	15	25	26.67	21.67
3	Motivation	58	5.18	8.62	27.59	27.59	31.03
4	Empathy	60	10	3.33	30	23.33	33.33
5	Social Skills	60	6.67	10	25	30	28.33
6	Relationship Management	60	5	0	26.67	33.33	35

Table 1.1 represents the percentage of bank employees who have responded to emotional intelligence questions.

Job Satisfaction Factors
Table 1.2: Collective Percentage Level of Job Satisfaction Factors

Sr. No.	Factors of Job Satisfaction	No. of Respondents Answered	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
			1	2	3	4	5
1	Compensation & Working Conditions	60	6.67	3.33	26.67	33.33	30
2	Work-Life Balance	60	5	8.33	25	30	31.67
3	Respect & Recognition	60	10	8.33	20	25	36.67
4	Job-Security	60	5	0	33.33	30	31.67
5	Career-Growth	60	3.33	5	28.33	33.33	30
6	Challenges	60	6.67	3.33	30	26.67	33.33

Table 1.2 represents the percentage of bank employees who have responded to job satisfaction questions.
Table 1.3: Mean Scores of Emotional Intelligence Factors

Sr. No.	Emotional Intelligence factors	Mean Scores
1	Self-Awareness	3.75
2	Self-Regulation	3.31
3	Motivation	3.70
4	Empathy	3.67
5	Social Skills	3.60
6	Relationship Management	3.93

From table 1.3 it is clear that all these factors are responsible for emotional intelligence. Highest responsible emotional intelligence factor is Relationship Management. Other factors are also important as per their mean scores.

Table 1.4: Mean Scores of Job Satisfaction Factors

Sr. No.	Job Satisfaction factors	Mean Scores
1	Compensation & Working Conditions	3.77
2	Work-Life Balance	3.75
3	Respect & Recognition	3.70
4	Job-Security	3.83
5	Career-Growth	3.81
6	Challenges	3.76

From table 1.4 it is clear that all these factors are responsible for job satisfaction. Highest responsible job satisfaction factor is Job-Security. Other factors are also important as per their mean scores.

Mean of X = 3.54	Mean of Y = 3.76	r = +0.63

From above it clear that there is positive correlation between emotional intelligence and job satisfaction factors. Hence we can say that emotional intelligence and job satisfaction are highly correlated.

Conclusion

Emotional intelligence and Job satisfaction is the hottest issues in the management research. Job satisfaction has been researched in different industrial environment and also at different level of employee's roles and responsibilities dimensions. However the recent management and organizational behavior research has twisted its focus on emotional intelligence to handle of the ability of people to know their emotions and understand others emotions to deal with ecological demands and pressures. In this study, it can be concluded that bank employees' scores on emotional intelligence tend to be positively correlated with their scores on job satisfaction. It means all the factors of emotional intelligence are correlated to job satisfaction factors.

Suggestions

In organizations, Emotional Intelligence programs should be used to construct organizational capability for bringing out the greatest in people and forming influential workplace for good job and good relationships. It is help to boost engagement, trust and truthfulness to build up power full and effective teams, retain good employees, offer exceptional customer care, and effectively manage change.
Development of skills like communication skills, logical skills, comprehension skills, creative skills, and management skills must get priority.
 Emotional quotient test should be used in organizations for giving promotions and recruitment etc.

Limitations of the Study

The scope of the study was restricted to a single industry therefore the results might not be applied to other industries. It is well known that no two persons perceive things alike. To this extent, the finding of the study would possibly suffer from the bias within the respondents. Survey opinion gets distorted by extreme views. It would be troublesome to identify such cases and eliminate them. As a result, the conclusions may not reflect really in some issues.

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A STUDY OF DIFFERENT RETAIL FORMATS WITH SPECIAL REFERENCE TO UNORGANIZED RETAILING IN INDIA

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Abstract

The Indian retail sector is going through a transformation and this emerging market is witnessing a significant change in its growth and investment pattern. Both existing and new players are experimenting with new retail formats. Currently two popular formats -hypermarkets and supermarkets are growing very fast

The retail format is the store package that the retailer presents to the shopper. The retailer uses the store to give out messages to customers about the product that will be available, the prices that customer can expect to pay & the range of additional services that the retailer may offer the customer**.** The aim of this paper is to study various forms of retail & their characteristic. This paper is based on secondary data & descriptive research design .The Indian retail industry is the fifth largest in the world. Retail is India's largest industry, accounting for over 10 percent of the country's GDP and around eight percent of employment. It has emerged as one of the most dynamic and fast paced industries with several players entering the market.

The Indian retail industry is generally divided into two major segments – organized retailing and unorganized retailing. The various factors affecting the retail formats are location, size, price, atmosphere & service .The retail formats are classified on the basis of ownership, store based & non store based. The practice of retailing is continuously evolving. New formats are born and old ones fade. Some of the new formats that have developed recently are mobile vans, Video kioks, mall, supercentres and liquidators. Modern retail has entered India as seen in sprawling shopping centers, multi-storied malls and huge complexes offer shopping, entertainment and food all under one roof.

The present paper study different retail formats available in India with special reference to unorganized retailing.

Introduction

The Indian retail industry is the fifth largest in the world. Comprising of organized and unorganized sectors, India retail industry is one of the fastest growing industries in India, especially over the last few years. Though initially, the retail industry in India was mostly unorganized, however with the change of tastes and preferences of the consumers, the industry is getting more popular these days and getting organized as well. With growing market demand, the industry is expected to grow at a pace of 25-30% annually. The Indian retail sector is highly fragmented, consisting predominantly of small, independent, owner-managed shops. The domestic organized retail industry is at a nascent stage. We can see more than 12 million retail outlets in India, and India has highest density of retail outlets in the world. Retail in India has evolved to support the unique needs to our country given its size and complexity. Haats, Mandis and Melas have always been a part of the Indian landscape. Retail is currently the booming sector of the Indian economy. This trend is expected to continue for at least the next two-three decades, attracting huge attention from all quarters of the economy—entrepreneurs, business heads, investors as well as real estate owners and builders. Retail sector is also expected to create huge employment as it will expand across the country at a massive scale. The Indian retail industry, consisting of over 13 million outlets is estimated to provide employment to over 18 million people, the largest employment after agriculture.

The Indian retail sector is highly fragmented with 97 per cent of its business being run by the unorganized retailers like the traditional family run stores and corner stores.

Since 2001, 49 global retailers entered 90 new markets, but at the same time, 17 retailers left markets in 2005.The Indian retail industry in valued at about $300 billion and are expected to grow to $427 billion in 2015 and $637 billion in 2020. Retail is India's largest industry, accounting for over 10 percent of the country's GDP and around eight percent of employment. Retail in India is at the crossroads. It has emerged as one of the most dynamic and a fast paced industry with several players entering the market. Retailing has become such an intrinsic part of our everyday lives that it is often taken for granted. The nations that have enjoyed the greatest economic and social progress have been those with a strong retail sector.

There is increased sophistication in the shopping pattern of consumers, which has resulted in big retail chains coming up in most metros; mini metros and towns being the next target. Consumer taste and preferences are changing leading to radical alteration in lifestyles and spending patterns which in turn is giving rise to new business opportunities. Companies need to be dynamic and proactive while responding to the ever-changing trends in consumer lifestyle and behavior.

The generic growth is likely to be driven by changing lifestyles and by strong surge in income, which in turn will be supported by favorable demographic patterns. Rapid growth in international quality retail space brings joy to shoppers and shopping malls are becoming increasingly common in large cities.

The number of department stores is growing at a much faster pace than overall retail, at 24 per cent annually. Supermarkets have been taking an increasing share of general food and grocery trade over the last two decades.

Development of mega malls in India is adding new dimensions to the booming retail sector. Shopping experience in the nation of shopkeepers is changing and changing very fast. There is significant development in retail landscape not only in the metros but also in the smaller cities. Retailing symbolizes consumerism. The east European countries experienced a low rate of growth when they were under the communist regime. After these countries opened up to the market forces & became part of the emerging economies, retailing become on of the forces driving consumption .Many international retailers gained instant popularity as they provided the customers a different shopping experience .A similar situation is now being witnessed in India, where new formats stores like Shoppers stop, Big bazaar, etc have become places to see & be seen in, and customers are deriving a significant utility out of shopping.

Objective of the study

The aim of this paper is to study various forms of retail formats & their characteristic.
The present paper tries to understand the retail sector in India, especially the modern retail formats, its attribute & type of goods they are offering.

Research Methodology

The present study is based on secondary data & information is collected from various sources like books, magazines, internet ,newspapers, journals & articles. The present study is descriptive research design in nature.

Retailing – Meaning

Retailing is all around us. It permeates our lives Retail, in general, means selling in small quantities .Retailing involves the sale of merchandise from a fixed location, such as store, for direct consumption by the customer .It can be defined as an activity that ensures that customers derive maximum value from the buying process. This involves activities & steps needed to place the merchandise made elsewhere in to hands of customers or to provide services to the customers

.Retailers organize the availability of merchandise on a large scale & supply them to consumers on a small scale.

Retail, in general, means selling in small quantities. In a laymen's parlance retailing is a term which can encompass sale of goods and merchandise for personal or household consumption either from a fixed place like market, shops or more recently, departmental stores, supermarket, shopping malls etc. It all started through small shops selling goods but lately came the huge stores ushering in retail revolution in India. There are three major types of retailing, first is Market where buyer and seller are in contact. This involves selling on the sidewalks, streets etc. The second form involves shop or shop trading where goods are out of buyers reach and kept at a distance which the seller supply them on demand. The third type is virtual selling where products are offered online and then selling is done involving e-mail, online shopping.

Definition of Retail
There are many approaches to understanding and defining retailing; most emphasize retailing as the business activity of selling goods or services to the final consumer.
Retail is defined as:

'Any business that directs its marketing efforts towards satisfying the final consumer based upon the organization of selling goods and services as a means of distribution'.

The concepts assumed within this definition are quite important. The final consumer within the distribution chain is a key concept here, as retailers are at the end of the chain and are involved in a direct interface with the customer. However, the emphasis on final consumer is intentionally different from that on customer: a consumer is the final user of a purchase whereas a customer may have bought for his or her own use, as a present or as part of an own business activity. Purchases for business or industrial use are normally not retail transactions.

The Evolution & History Of Retailing

Retailing it started as a very primitive business but today has grown tremendously. First people were doing businesses with their neighbors. Goods were exchanged between them. Gradually people began to collect themselves to a given neighborhood, which provides a geographical place to do the exchange. Retailing as an occupation came in to existence when farmers started producing more food than they required. Trading was an important part of daily life in the ancient world.

In India, the existence of the current kirana formats & other shops can be traced to the Manusmriti & Arthshastra.These text provided guidelines for dealing with customers, after sales services , price , & quality. They also defined the tax structure for retail & wholesale

transactions. Descriptions of local & periodic haats have also been found. These were the places where commodity exchange was carried out & people derived several non economic values.Infact, ancient ruins indicate that the world's first department store was in Rome. Tea centers run by Lipton were the first chain of store. At the start of the 20th century, markets were witnessing the precursors to the present day retailing scenario.

Based on the ICICI Research, the Indian Retail Market evolution can be traced in the following way:
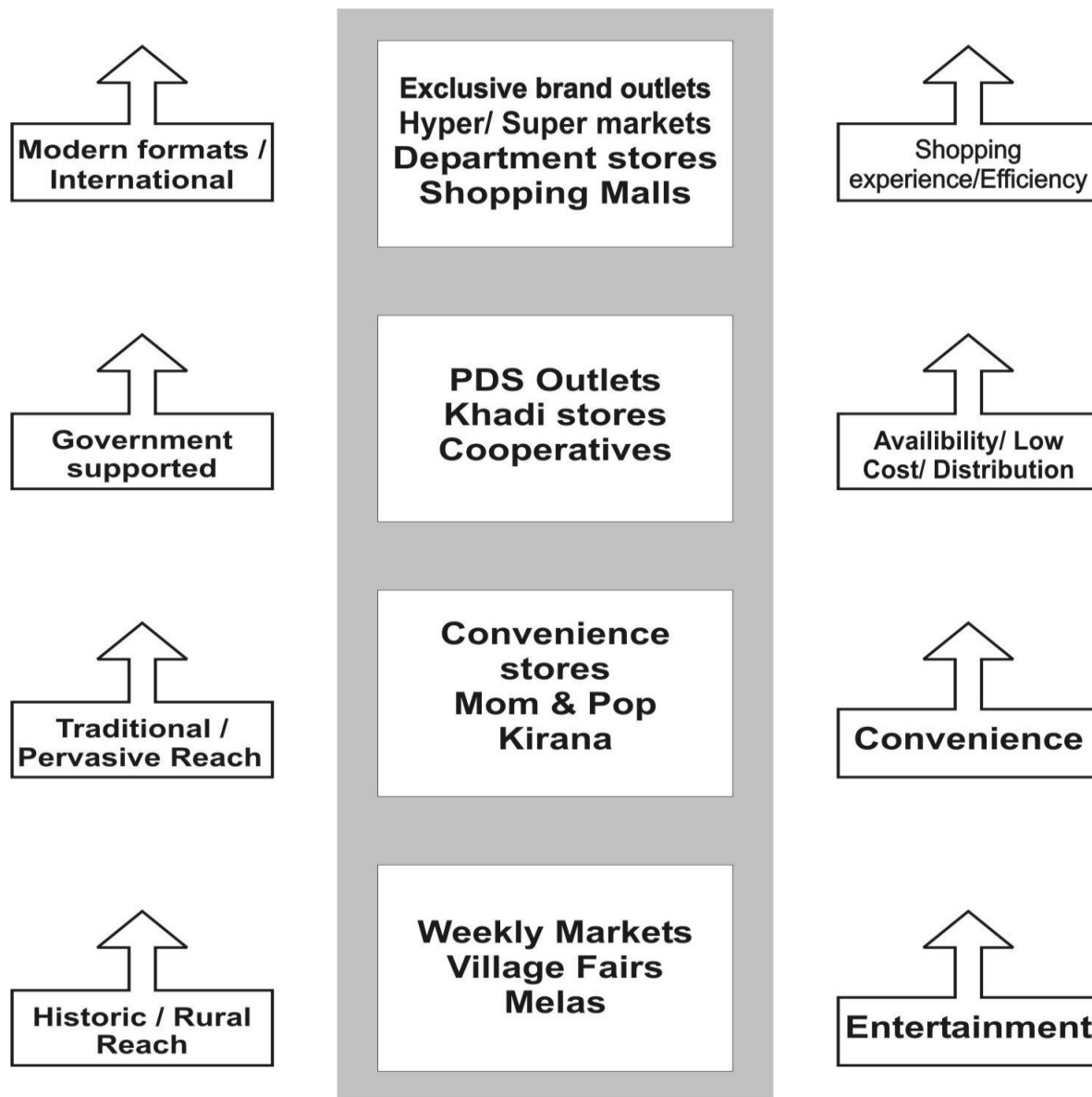
Source:- ICICI Bank (2004 February) White Paper Pitches for Foreign Direct Investment in Retail.

Drivers of Retail

On one hand favorable demographic and psychographic changes in the Indian consumer class, rising income, international exposure, availability of quality retail space, wider brand choice and better marketing communication are some of the factors driving Indian retail. On the other side a lot depends on the preparedness of Indian retailers in terms of having suitable formats, scalable business model, appropriate technology and relevant organization capability for the success.

Currently the country has a population of over one billion, 60% of which is under 30 years of age. This means majority of the population is young and working class with higher purchasing power. The low median age of population means a higher current consumption rate which augurs well for the retail sector. Consumer spending in India has grown at over 12 percent since mid-1990s and 64 per cent of Indian GDP is accounted for by private consumption. Over the last decade, the average Indian spending has gone up from INR 5,745 in 1992-93 to INR 16,457 in 2003-04 and is expected to grow around its trend rate of 20 percent by 2020.

There are fundamental but significant changes underway in this country. In January 2006, the government announced that foreign companies can own up to 51 percent of a single-brand retail company, such as Nike or Adidas. This decision would certainly encourage retailers such as Zara and Gap to enter this market.

Division of Indian Retail Industry

The Indian retail industry is generally divided into two major segments – organized retailing and unorganized retailing.

(a) **Organized Retailing** - refers to trading activities undertaken by licensed retailers, that is, those who are registered for sales tax, income tax, etc. These include the corporate-backed hypermarkets and retail chains, and also the privately owned large retail businesses. The unorganized sector is a critical part of the Indian economy . The last few years have witnessed the entry of a number of organized retailers opening stores in various modern formats in metros and other important cities .

(b) **Unorganized Retailing** - refers to the traditional formats of low-cost retailing, for example, the local kirana shops, owner manned general stores, paan/beedi shops, convenience stores, hand cart and pavement vendors, etc. The unorganized retail sector is expected to grow at about 10% per annum. Unorganized retailers normally do not pay taxes and most of them are not even registered for sales tax, VAT, or income tax. According to AT Kearney report for the year 2011, Organized retail accounts for 7 per cent of India's roughly US$ 435 billion retail market and is expected to reach 20 per cent by 2020.

FORMATS OF RETAILING

A business format is the manner in which a business chooses to serve its customers and stakeholders. In retail, a business model would dictate the product and/or services offered by the retailer, the pricing policy that he adopts, the communication that he follows to reach out to his customers and the size, look and the location of his retail store.

Emerging retail formats provide a wide variety to customers and offer an ideal shopping experience with an amalgamation of product, entertainment and service, all under a single roof.

Indian retail scenario, with the intervention of organized retail in the form of modern retail formats such as one-stop malls, speciality malls, hyper markets and big-box retailing, has witnessed a remarkable shift in the preferences of consumers. According to Hino (2010) the emergence and expansion of supermarkets has gradually decreased the market share of the traditional formats. Malls comprise 90% of the total future retail development. The basic reason for the growth of malls is that it offers an experience and not just goods.

Factors affecting Retail formats

This can be defined according to different attributes-

1.Location- store location significantly affects customer's expectation .Store in out of town shopping centre's will have to offer a superior selection to attracts customers .For the factory outlet , the attraction must be suitable range of high class brand names at bargain price & for the store at an out of town retail centre , the expectation is one of the quality & range.

2.Size- The size of the store affects customer expectation as to the range of products stocked. Small boutiques will be expected to stock an interesting variety of a limited assortment of products.

3.Price – A supermarket is expected to charge low prices & offer a wide range & deep assortment .Discount sores are expected to provide relatively limited range at lower prices. Specialists shops are expected to provide a comprehensive range of products.

4.Atmosphere & service – sense of quality or low price , full service or limited service are all signals that customer pick up & use in deciding where to shop.

Different retail formats in India

Classification on the Basis of Ownership

On the basis of ownership, a retail store can be an independent retailer, a chain retailer or a corporate retail chain, a franchise or a consumer co-operative.

1. Independent Retailer

An independent retailer is one who owns and operates only one retail outlet. Such an outlet is managed by the owner & proprietor and a few other local hands or family members working as assistants in the shop. Many independent stores tend to be passed on from generation to generation.

2. A Chain Retailer Or A Corporate Retail Chain

When two or more outlets are under a common ownership, it is called a retail chain. These stores are characterised by similarity in the merchandise offered to the consumer, the ambience, advertising and promotions. Examples in India include Wills Sports (ITC), Louis Phillippe, Van Heusen (Madura Garments), Arrow (Arvind Mills) and department stores like Globus, Westside and Shopper's Stop. Food world, Music world, Planet M, etc., are also examples of chain retailers.

3. Franchising

A franchise is a contractual agreement between the franchiser and the franchisee, which allows the franchisee to conduct business under an established name as per a particular business format, in return for a fee or compensation.

4. Leased Departments

These are also termed as shop-in-shops. When a section of a department in a retail store is leased/ rented to an outside party, it is termed as a leased department. A leased department within a store is a good method available to the retailer for expanding his product offering to the customers. In India, many large department stores operate their perfumes and cosmetics counters in this manner.

General Merchandise Retailers-

The major formats used by general merchandise retailers are-

1. Department store

Department stores are large retailers that carry wide breadth and depth of products. They offer more customer service than their general merchandise competitors. Department stores are named because they are organized by departments such as juniors, mens wear, female wear etc .A retailer of such store carries variety of categories and has broad assortment at average price. They offer considerable customer service. Each department is act as "ministore". Means the each department is allocated the sales space, manager and sales personnel that they pay a attention to the department

2.Full line Discount store

Discount stores tend to offer a wide array of products and services, but they compete mainly on price offers extensive assortment of merchandise at affordable and cut-rate prices. Normally, retailers sell less fashion-oriented brands. It convey the image of a high volume, low cost, fast turnover outlet selling a broad merchandise assortment for less than conventional prices.   Less fashion sensitive merchandise is carried . Products are sold via self service. A customer service is not provided within stores but at centralized area. It is more to carry the range of products line expected at department stores, including consumer electronics, furniture and appliances. There is also greater emphasis on such items as auto accessories, gardening equipment, and house wares.

3.Specialty store

Specialty store carry a limited number of product within one or few lines of goods and services. They are named because they specialize in one type of product, such as apparel and complementary merchandise. Specialty retailers tend to specialize in apparel, shoes, toys, books, auto supplies, jewelry and sporting goods. Specialty store utilizes a market segmentation strategy rather than typical mass marketing strategy when trying to attract customers. A specialty store has a narrow marketing focus - either specializing on specific merchandise, such as toys, shoes, or clothing, or on a target audience, such as children, tourists, or oversize women. Such stores, regardless of size, tend to have a greater depth of the specialist stock than general stores, and generally offer specialist product knowledge valued by the consumer.

4.Off price Store

Off price retailers resemble discount retailers in that they sell brand name merchandise at everyday low prices. Off price retailers rarely offer many services to customers. The key strategy of off price retailers is to carry the same type of merchandise as traditional department stores but offer prices that can be 40 to 60 percent lower. To able to offer the low prices, off price retailers

develop special relation ship with their suppliers for large quantity of merchandise. Inventory turnover is the key factor of successful off price retailing business

5.Variety store

Variety stores offer extremely low-cost goods, with limited selection. Variety store offer deep assortment of inexpensive and popular goods like stationary, gift items, women's accessories, house wares etc .They are also called 5 to 10 percent store because the merchandise in such stores, used to cost much .They face competition mainly from speciality store & discount store .

Non store based Retailer-

This is a form of retailing in which sales are made to consumers without using physical store .They are known by the medium they used to communicate with their customers. They offer consumer the convenience of making purchase anytime throughout the year & delivery at a location & time of their choices. This includes-

1. Direct Selling

Direct selling involves making a personal contact with the end consumer at home or at the place of work. Cosmetics, jewellery, food and nutritional products, home appliances and education materials are some of the products sold in this manner.

Direct selling may follow the party plan or the multilevel network. In the party plan, the host invites friends and neighbours for a party. The merchandise is displayed and demonstrated in the party atmosphere and buying and selling takes place.

2. Mail Order Retailing / Catalogue Retailing:

This form of retailing eliminates personal selling and store operations. Appropriate for specialty products, the key is using customer databases to develop targeted catalogues that appeal to narrow target markets. The basic characteristic of this form of retailing is convenience.

3. Television Shopping

 Asian Sky Shop was among the first to introduce television shopping in India. In this form of retailing, the product is advertised on television, details about the product features, price and things like guarantee / warranty are explained. Phone numbers are provided for each city, where the buyer can call in and place the order for the product. The products are then home delivered.

4. Automatic Vending / Kiosks:

This is the most impersonal form of retailing. However, it provides convenience to the customers, as they have access to the products round the clock. It is a popular form of retailing abroad and is used to sell routinely purchased items like soft drinks, candy, cigarettes and newspapers. While tea and coffee vending machines are a popular sight at the airports in India, the Automated Teller Machines operated by banks are perhaps the most successful example of automated vending in India.

Other retailing formats-

The practice of retailing is continuously evolving. New formats are born and old ones fade. Incessant pressure to improve efficiency & effectiveness & to serve the customer in a better way.Some of the new formats that have developed recently are discussed below-

Mall
A mall would consist of several retail outlets each selling their own merchandise but at a common platform. They has a range of retail shops at a single outlet. They endow with products, food and entertainment under a roof. Shopping malls are the largest form of organized retailing today. These are located mainly in metropolitan cities, in proximity to urban outskirts. The area of shopping malls ranges from 60,000 sq ft to 7,00,000 sq ft and above. The idea is to lend an ideal 'shopping experience' which includes an amalgamation of product, service and entertainment all under a common roof. Examples include In orbit Mall in Mumbai, Ansal Plaza in Delhi, South City mall in Kolkata

Recycled merchandise retailer
 Recycled merchandise retailers are a product of great depression, which sell cast-off clothes; furniture, sporting goods and computers. They include pawnshops, thrift shops, consignment shops and even flea markets. Due to their very small numbers just a decade ago, recycled merchandisers have experienced the fastest growth of any retail format over the past five years. Even as a record number of retailers were seeking bankruptcy protection in the mid–1990s, these recycled merchandise retailers were growing at 10 percent a year. Recycling is not just an American phenomenon; it is also big in Europe and Latin America. However, it is growing fastest in Japan where this retail format is expanding at nearly a 20 percent annual rate. Japanese companies from kimono stores to catalogue retailers have jumped on the second-hand bandwagon. One of the most popular stores in Japan is called "Per Gram Market", which sells items at eight cents a gram. Thus, a second-hand T-shirt would cost around $ 8.50, but a silk scarf would sell for $2.8070. Recyclers have developed to serve specific markets, such as pregnant women, large sizes or children, or even specific merchandise such as toys, sporting goods (including camping and backpacking equipment), outwear, CDs, tools or jewellery. The apparel group accounting for the lowest resale and thrift store sales is men's clothing. The reason

being that men hang onto their clothes longer than women and children do, leaving much less available for resale.

Liquidators

Liquidators are a retail format that comes in and liquidates leftover merchandise when an established retailer shuts down or downsizes. They make their money by seldom paying more than 30 cents on the wholesaler price for the closeout retailers. They are often called retailing's undertakers or vultures. Retailers utilise the services of liquidators because running closeouts requires some special retailing skills.

Liquidators have a talent for pricing merchandise and estimating the expense of everything from ad budgets and payrolls to utility bills. Liquidators also have to develop special incentive plans to make it more profitable for store personnel to stay and work rather than quit or walk off with merchandise

Video kiosks

The video kiosk is a freestanding, interactive, electronic computer terminal that displays products and related information on a video screen. It often uses a touch screen for consumers to make selections. Video kiosks can be situated anywhere (from a store aisle to the lobby of a college dormitory to a hotel lobby). They require enable consumers to place orders, complete transactions (typically with a credit card) and arrange for products to be shipped. Kiosks can be linked to retailers' computer networks or tied in to the web. Many shopping centres and individual store-based retailers are setting up video kiosks in open hallways.

At the beginning of 1999, there were about 250,000 video kiosks, in use through out the United States. It is estimated that there will be 1.7 million U.S. kiosks by the end of 2003. It is also forecast that video kiosk sales will rise from $830 million in 1999 to $3 billion in 2003. Worldwide, nearly 80 percent of kiosks are involved with retail related transactions. North America accounts for 59 percent of kiosk sales, the Pacific Rim for 20 percent, Europe for 16 percent and the rest of the world for 5 percent Car boot sales .

Mobile vans-

These are modified vehicles usually poultry and meat products, library books, etc. They move from location to location, for fixed periods of time, thus providing convenience by coming closer to customers.
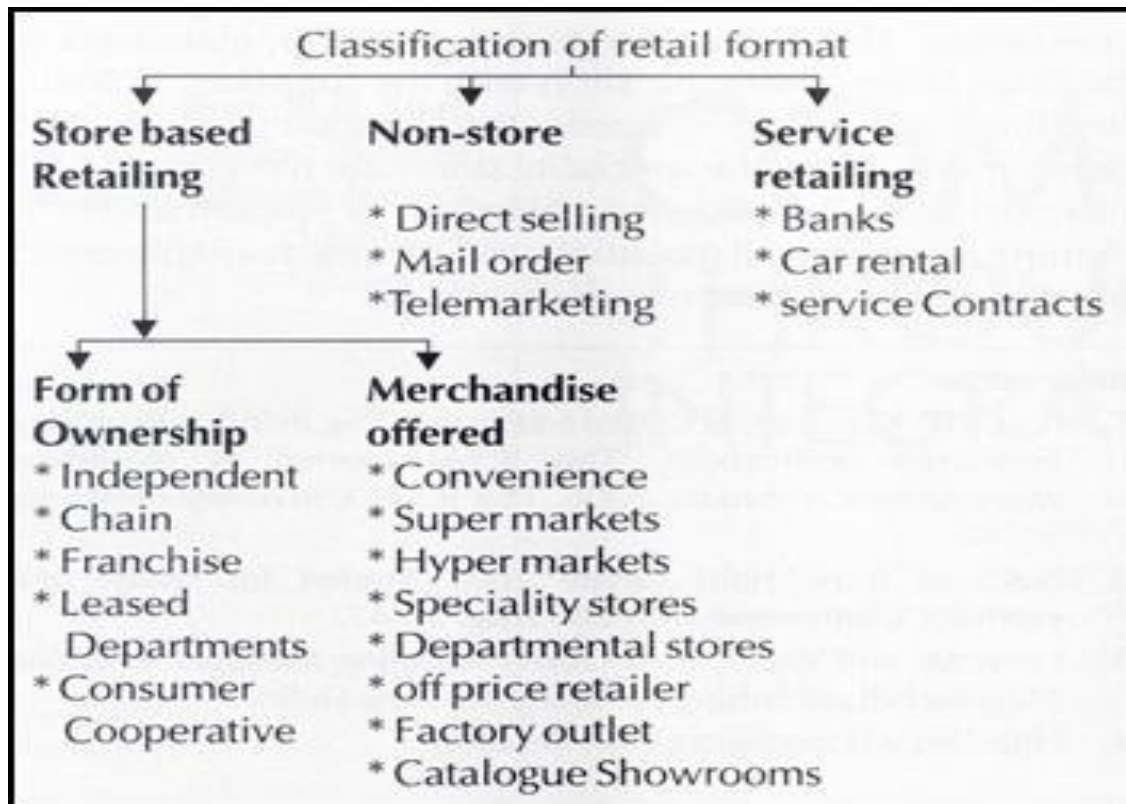
Findings-

The retail canvass is dotted with several formats. These are broadly classified into store and non-store formats and on the basis of their ownership. Each format has a specific driver that makes it succeed. A retailer needs to identify one aspect that would provide sustainable competitive advantage. The selection is dependent on the target customers, competition and the objectives of the retailers. The ownership based classification is further divided in to independent, chain, franchise, leased department, vertical marketing system & consumer cooperatives. Another classification is store based which is further classified in to convenience store , speciality store , variety stores , full line discount stores , factory outlets & combination store . Last classification is based upon non retail store which is further divided in to vending machine , online store , telemarketing , teleshopping , E retailing & direct marketing .

Conclusion-

The present research examines the various retail formats as well as the emergence of modern retail formats in India. The findings of the paper reveal that consumers' prefer malls and specialty store to purchase various shopping goods like clothing, Footwear and Jewellery.

Retail format is one of the vehicles to deliver value proposition and also it helps to position the store in the mind of target shoppers. Probably in a growing market no one finds difficulty in

pulling customer into store but that may not be sufficient to operate profitably. Retailers need to find out what matches consumer requirement and offer better than competition. Retailers certainly need to be innovative in designing the value proposition and deciding the format to deliver that to the consumer. It is not all about deciding the format but all about serving the consumer better, faster and at less cost. Retailers can use their store as an indicator of what they stand for and what value they offer . Retailers have to out think consumer in providing service and value.

Retailers should create value for the consumer and must decide suitable vehicle to deliver desired consumer value. No doubt that retail format is one of the vehicles to deliver value proposition and also it helps to position the store in the mind of target.

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A STUDY ON RELATIONSHIP BETWEEN INNOVATION AND ECONOMIC GROWTH OF INDIA

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Abstract: For achieving long term sustainable economic growth of any country the key factor required is innovation. Today India is one of the fastest growing economies in this modern globalization world.Indian economy is enjoying the average economic growth of 7% from last two decades, but again the question arises is that whether this economic growth sustainable or only some short-term phenomena. Hence to achieve long-term sustainable growth what is needed most is Innovation. The purpose of this paper is to study the relationship between innovation and economic growth in India. For this study, data of last 10 years is analyzed i.e. from 2008 to 2017. For the purpose of this study Majority of the data was sourced from World Bank data banks. Due to non-availability of the data, the study is restricted to secondary data collected on GDP growth rate, per capital GDP growth rate, Research & Development spending as a percentage of GDP, number of patents application filed and FDI.According to the results shown in the study, an increase in economic growth of the country will decrease the number of patents and also decrease the spending on Research and development activities of the economy. Hence the dream of sustainable economic growth is still questionable.
Keywords: Innovation, Economic Growth, GDP growth rate, R&D expenses, Foreign Direct Investment.

Introduction: Now a day, it is very important to be innovative. Everywhere there is a talk about innovation. Today innovation is considered as one of the major factor that leads to economic growth. Every economy is thriving hard to achieve economic growth, since their main objective is to achieve economic growth for their society and for their nation. In this journey of achieving economic growth, innovation played a major part right from the invention of wheel to invention of internet. Innovation now a day, is necessary for achieving the demand for new products and also to achieve higher standard of living. In recent times, all the developed countries are spending major part of their revenue on research and development, such expenditure is much higher than the total budget of some developing and underdeveloped countries. This difference is the major driving force that makes developed countries a leading country as compared to other developing and underdeveloped countries where investment in R & D is very low. To become a dominant economy, all the economic activities should be directed towards achieving sustainable economic growth in the economy. In order to become a front runner, an economy should have a

goal of achieving long term sustainable economic growth, this goal can be achieved by increasing the general output level of the economy. Gross Domestic Product (GDP) measures the economy's output in a given period of time usually a year. There is always an argument about GDP as a measure of economic growth but this paper GDP is recognized as measure of economic growth.There GDP can be increased by the following ways: a) by increasing the number of units introduced in the production process; and b) by increasing the productivity of the units introduced. In order to increase the GDPthere are two ways: (1) by increasing the no. of inputs that we use into the production process.(2) By increasing the productivity of inputs.

Innovative techniques can be applied for increasing the productivity of the inputs, this can be done by innovating new product or by innovating new production process.

Productivity can be increased by innovating newproducts or by innovating new production processes.

The main objective of this paper is to study the relationship between innovation and economic growth of India. However, it is not easy to measure innovation, but this can be studied with the help of various factors than can explain the innovation in an economy, like number of patents registered, technological advances in the economy, spending in sectors like education, etc. In this paper innovation is studied on the basis of factors like number of patents registered, spending on education and research and development expenditure of the economy. This is because number of patents filed represents innovative development of the economy and keeps the economy in the path of increasing productivity and achieving long them sustainable economic growth. At the same time increase in spending on education and spending on Research & Development by an economy will increase the productivity of the labors. This research papers will help to the economy to make some policy decisions which ultimately will help in attaining long term sustainable growth.

Literature Review: The literature review is done to highlight the importance of innovation in economic growth of economy. **Nathen Rosenberg (2004)** illustrates that technological innovation is considered to be as a major factor in economic growth and hence he focuses on some of the most distinctive features of innovation in the highly industrialized economies of the OECD area. He attempts to examine a primary single feature, "uncertainty" that dominates the search for new technologies by drawing several cases on the American experience. It also touches on the impact of technological innovation in the tourism industry and how it is transforming the tourism business model.

According to Andrea m Pece et al (2015), The innovation, R&D expenditures and the investments in technology are premises for ensuring competitiveness and progress, and through them a sustainable economic growth. A sustained level of education of the workforce, increasing investments in research area, the creation of the new products and the facile access of investors to stock markets, firstly, will ensure the development of the private and public sectors, and

secondly, will improve the living conditions of the population. The purpose of their research was to analyze if the long term economic growth is influenced by the innovation potential of an economy. Their analysis was performed by using multiple regression models estimated for the following CEE countries, namely Poland, Czech Republic and Hungary. In order to quantify the innovation, they have used various variables, such as number of patents, number of trademarks, R&D expenditures. The results provide evidence of a positive relationship between economic growth and innovation.

An altogether new aspect which so far has not been dealt with in depth in economic literature is the role for economic growth. Technological activities are although very important and essential determinant of the economic performance of industrialized economies is generally acknowledged today. However, greater attention is received on the role of the patent system in economic growth. Nordhaus (1969). Blind, K., & Jungmittag, A. (2008).) Ortiz-Villajos, J. M. (2009) Performed a quantitative analysis on to study the relationship between technology and economic growth of over twenty countries. It was found during their research it is seen that there is positive effect of correlation between patents and per capita income. OrtizVillajos, J. M. (2009) in his research studied the regressions between the time series of patent applications in Spain between 1826 and 1985 and some economic variables. The study indicate that there is a positive correlation between patents and Gross Fixed Capital Formation.

Research Methodology: This paper analyses the relationship between innovation and economic growth in India. For this study, data of last 10 years is analyzed i.e. from 2008 to 2017. Many thinkers and researchers have defined the importance of innovation in economic growth of the economy. The have called it as New Economy, according to DeLong and summers (2001), the "essence of the New Economy" as the intensive use of technology in general, and information technology. At the same time the Canadian government (2002) describes the "New Economy" as "an Economy that is producing or intensively using innovative or new technologies". Hence it is clear from the above definition that innovation is very important for the growth of an economy.

Due to lack of resources available, it was difficult to find the data for the study. Majority of the data was sourced from World Bank data banks. Due to non-availability of the data, the study is restricted to secondary data collected on GDP growth rate, per capital GDP growth rate, Research & Development spending as a percentage of GDP, number of patents application filed and FDI.

Objective of the Study: The objective of the study is to study the relationship between the innovation and economic growth of India.

Data Analysis: This paper analyses the relation between innovation and economic growth in India using regression model where the dependent variable is the GDP growth rate. The others variables were included in the analysis as independent variables.

GDP Growth: GDP growth rate is the real growth rate of gross domestic products from one year to the other in India's economy. This variable very well resembles the economic growth of an economy in a given period of time.

GDP Per Capita Growth: To measure the economy's standard of living GDP per capita growth is used. There is always a positive correlation between GDP growth rate and per capita GDP growth rate but due to rapidly increasing population in India, it is important to consider both the measure simultaneously.

R&D Expenditure: The quantum of R&D expenditure as a percentage of GDP is also a good representative for the intensity of innovation in an economy. A higher the value the greater the concern to state regarding the technological development.

Patents: The number of patents applications registered by the national patent office represent there is exclusive rights for an invention. A protection is given by Patent for the invention to the owner of the patent for a limited period, normally for 20 years

The following table 1 shows the descriptive statistics of the variables used in the model to analyze the relationship between economic growth and innovation

Table 1 Descriptive Statistics

Year	GDP growth %	GDP per capita growth (annual %)	Patent applications	Research and development expenditure (% of GDP)	Foreign direct investment (% of GDP)
2008	3.0867	1.58272525	6425	0.73548	3.62052
2009	7.86188	6.34085065	7262	0.72901	2.65159
2010	8.49759	7.02473248	8853	0.76713	1.63503
2011	5.24131	3.86969482	8841	0.8358	2.00207
2012	5.45639	4.13471779	9553	0.82217	1.31293
2013	6.38611	5.09669173	10669	0.81554	1.51628
2014	7.41023	6.14033404	12040	0.8674	1.69566
2015	7.99625	6.74270031	12579	0.84444	2.09212
2016	8.16953	6.93461141	13199	0.82213	1.94106
2017	7.16789	5.96681181	14961	0.83125	1.50774
Mean	6.72739	5.38338703	10438.2	0.80704	1.9975
Standard Deviation	1.69855	1.73704083	2734.99	0.04689	0.68611
Skewness	-1.167	-1.2762999	0.14979	-0.791	1.69039
Kurtosis	0.95296	1.27262668	-0.9116	-0.6281	3.02608

Source: World Bank Database

Model: This paper uses multi regression model to achieve the proposed objectives. The model used in the paper is as follows:

GDP growth rate = α + β(GDP per capita growth) + β(Patent) + β(R&D) + β(FDI)

The multi-collinearity test has been performed to identify the multi-collinearity among the variables. The correlation matrix for the model variables is presented in Table 2.

Table 2 Correlations

	GDP growth %	GDP per capita growth (annual %)	Patent applications	Research and development expenditure (% of GDP)	Foreign direct investment (% of GDP)
GDP growth %	1.000				
GDP per capita growth (annual %)	.998	1.000			
Patent applications	.512	.564	1.000		
Research and development expenditure (% of GDP)	.220	.274	.753	1.000	
Foreign direct investment (% of GDP)	-.492	-.524	-.603	-.671	1.000

The above table 2 shows the multicollinearity between two independent variables. This matrix explains multi collinearity between GDP growth % and GDP per capita growth and also between patents and R&D expenses. Table 2 shows the moderate positive correlation between GDP per capita which represents economic development of India and number of patents application which represents innovation in India. This analysis suggests that increase in per capital economic growth leads to motivate people for more innovations.

The strong positive correlation between patents and R&D expenses suggests that Indian economy gets stronger allocation of resources towards R&D Expenses can increase the innovation in India. Surprisingly, FDI however showed negative correlation with GDP growth, GDP per capita growth, Patents, and R&D Expenditure.

Table 3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000[a]	1.000	1.000	.02834

a. Predictors: (Constant), Foreign direct investment (% of GDP) , GDP per capita growth (annual %) , Patent applications , Research and development expenditure (% of GDP)

Table 4 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.962	4	6.490	8078.596	.000[b]
	Residual	.004	5	.001		
	Total	25.966	9			

a. Dependent Variable: GDP growth %

b. Predictors: (Constant), Foreign direct investment (% of GDP) , GDP per capita growth (annual %) , Patent applications , Research and development expenditure (% of GDP)

Table 5 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.177	.309		7.040	.001
	GDP per capita growth (annual %)	1.014	.008	1.037	132.029	.000
	Patent applications	-3.404E-005	.000	-.055	-5.328	.003
	Research and development expenditure (% of GDP)	-.716	.377	-.020	-1.901	.116
	Foreign direct investment (% of GDP)	.012	.021	.005	.587	.582

a. Dependent Variable: GDP growth %

Table 3 shows multiple R and R square which represents multiple correlation and coefficients of determination respectively. The R (1.00) explains that there is perfect correlation between dependent variable (GDP growth rate) and other independent variables used in the study. Lower P value shows the significance of the model. However negative coefficients represented in table 5 of the patent applications and Research & Development expenditure are surprising. That means if the Indian economy's economic growth rate will increase it will decrease the number of patent application filed and research and development expenditure in India. That seems unrealistic. Since the p-value is less than 0.05 ($p < 0.05$) as represented in table 4, this model is accepted, since lower P value indicates this model is significant.

Conclusion: For the economic growth and development of an economy, Innovation proves to be a key factor. Research and Development expenditure in the country and number of patents filed

in India enhances the long term sustainable economic growth of the country. India is gradually increasing its innovative practices, however the growth in innovative practices is not as expected. There is still a long way ahead towards achievement of economic growth in the economy. To achieve this goal primary focus should be to increase spending on education and research and development activities, which ultimately will increase the productivity in near future. The results obtained in this paper are not satisfactory. According to the results shown in the study, an increase in economic growth of the country will decrease the number of patents and also decrease the spending on Research and development activities of the economy. Hence the dream of sustainable economic growth is still questionable.

Like other studies, this study is also affected by some limitations, main limitation was non availability of the data. Also there are various vehicles which can be included in the study. These variables are not included due to non-availability of data

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A study on relationship between Innovation and Economic Growth of India

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Abstract: For achieving long term sustainable economic growth of any country the key factor required is innovation. Today India is one of the fastest growing economies in this modern globalization world.Indian economy is enjoying the average economic growth of 7% from last two decades, but again the question arises is that whether this economic growth sustainable or only some short-term phenomena. Hence to achieve long-term sustainable growth what is needed most is Innovation. The purpose of this paper is to study the relationship between innovation and economic growth in India. For this study, data of last 10 years is analyzed i.e. from 2008 to 2017. For the purpose of this study Majority of the data was sourced from World Bank data banks. Due to non-availability of the data, the study is restricted to secondary data collected on GDP growth rate, per capital GDP growth rate, Research & Development spending as a percentage of GDP, number of patents application filed and FDI.According to the results shown in the study, an increase in economic growth of the country will decrease the number of patents and also decrease the spending on Research and development activities of the economy. Hence the dream of sustainable economic growth is still questionable.

Keywords: Innovation, Economic Growth, GDP growth rate, R&D expenses, Foreign Direct Investment.

Introduction: Now a day, it is very important to be innovative. Everywhere there is a talk about innovation. Today innovation is considered as one of the major factor that leads to economic growth. Every economy is thriving hard to achieve economic growth, since their main objective is to achieve economic growth for their society and for their nation. In this journey of achieving economic growth, innovation played a major part right from the invention of wheel to invention of internet. Innovation now a day, is necessary for achieving the demand for new products and also to achieve higher standard of living. In recent times, all the developed countries are spending major part of their revenue on research and development, such expenditure is much higher than the total budget of some developing and underdeveloped countries. This difference is the major driving force that makes developed countries a leading country as compared to other developing and underdeveloped countries where investment in R & D is very low. To become a dominant economy, all the economic activities should be directed towards achieving sustainable economic growth in the economy. In order to become a front runner, an economy should have a goal of achieving long term sustainable economic growth, this goal can be achieved by increasing the general output level of the economy. Gross Domestic Product (GDP) measures the economy's output in a given period of time usually a year. There is always an argument about

GDP as a measure of economic growth but this paper GDP is recognized as measure of economic growth.There GDP can be increased by the following ways: a) by increasing the number of units introduced in the production process; and b) by increasing the productivity of the units introduced. In order to increase the GDPthere are two ways: (1) by increasing the no. of inputs that we use into the production process.(2) By increasing the productivity of inputs.

Innovative techniques can be applied for increasing the productivity of the inputs, this can be done by innovating new product or by innovating new production process.

Productivity can be increased by innovating newproducts or by innovating new production processes.

The main objective of this paper is to study the relationship between innovation and economic growth of India. However, it is not easy to measure innovation, but this can be studied with the help of various factors than can explain the innovation in an economy, like number of patents registered, technological advances in the economy, spending in sectors like education, etc. In this paper innovation is studied on the basis of factors like number of patents registered, spending on education and research and development expenditure of the economy. This is because number of patents filed represents innovative development of the economy and keeps the economy in the path of increasing productivity and achieving long them sustainable economic growth. At the same time increase in spending on education and spending on Research & Development by an economy will increase the productivity of the labors. This research papers will help to the economy to make some policy decisions which ultimately will help in attaining long term sustainable growth.

Literature Review: The literature review is done to highlight the importance of innovation in economic growth of economy. **Nathen Rosenberg (2004)** illustrates that technological innovation is considered to be as a major factor in economic growth and hence he focuses on some of the most distinctive features of innovation in the highly industrialized economies of the OECD area. He attempts to examine a primary single feature, "uncertainty" that dominates the search for new technologies by drawing several cases on the American experience. It also touches on the impact of technological innovation in the tourism industry and how it is transforming the tourism business model.

According to Andrea m Pece et al (2015), The innovation, R&D expenditures and the investments in technology are premises for ensuring competitiveness and progress, and through them a sustainable economic growth. A sustained level of education of the workforce, increasing investments in research area, the creation of the new products and the facile access of investors to stock markets, firstly, will ensure the development of the private and public sectors, and secondly, will improve the living conditions of the population. The purpose of their research was to analyze if the long term economic growth is influenced by the innovation potential of an economy. Their analysis was performed by using multiple regression models estimated for the

following CEE countries, namely Poland, Czech Republic and Hungary. In order to quantify the innovation, they have used various variables, such as number of patents, number of trademarks, R&D expenditures. The results provide evidence of a positive relationship between economic growth and innovation.

An altogether new aspect which so far has not been dealt with in depth in economic literature is the role for economic growth. Technological activities are although very important and essential determinant of the economic performance of industrialized economies is generally acknowledged today. However, greater attention is received on the role of the patent system in economic growth. Nordhaus (1969). Blind, K., & Jungmittag, A. (2008).) Ortiz-Villajos, J. M. (2009) Performed a quantitative analysis on to study the relationship between technology and economic growth of over twenty countries. It was found during their research it is seen that there is positive effect of correlation between patents and per capita income. OrtizVillajos, J. M. (2009) in his research studied the regressions between the time series of patent applications in Spain between 1826 and 1985 and some economic variables. The study indicate that there is a positive correlation between patents and Gross Fixed Capital Formation.

Research Methodology: This paper analyses the relationship between innovation and economic growth in India. For this study, data of last 10 years is analyzed i.e. from 2008 to 2017. Many thinkers and researchers have defined the importance of innovation in economic growth of the economy. The have called it as New Economy, according to DeLong and summers (2001), the "essence of the New Economy" as the intensive use of technology in general, and information technology. At the same time the Canadian government (2002) describes the "New Economy" as "an Economy that is producing or intensively using innovative or new technologies". Hence it is clear from the above definition that innovation is very important for the growth of an economy.

Due to lack of resources available, it was difficult to find the data for the study. Majority of the data was sourced from World Bank data banks. Due to non-availability of the data, the study is restricted to secondary data collected on GDP growth rate, per capital GDP growth rate, Research & Development spending as a percentage of GDP, number of patents application filed and FDI.

Objective of the Study: The objective of the study is to study the relationship between the innovation and economic growth of India.

Data Analysis: This paper analyses the relation between innovation and economic growth in India using regression model where the dependent variable is the GDP growth rate. The others variables were included in the analysis as independent variables.

GDP Growth: GDP growth rate is the real growth rate of gross domestic products from one year to the other in India's economy. This variable very well resembles the economic growth of an economy in a given period of time.

GDP Per Capita Growth: To measure the economy's standard of living GDP per capita growth is used. There is always a positive correlation between GDP growth rate and per capita GDP growth rate but due to rapidly increasing population in India, it is important to consider both the measure simultaneously.

R&D Expenditure: The quantum of R&D expenditure as a percentage of GDP is also a good representative for the intensity of innovation in an economy. A higher the value the greater the concern to state regarding the technological development.

Patents: The number of patents applications registered by the national patent office represent there is exclusive rights for an invention. A protection is given by Patent for the invention to the owner of the patent for a limited period, normally for 20 years

The following table 1 shows the descriptive statistics of the variables used in the model to analyze the relationship between economic growth and innovation

Table 1 Descriptive Statistics

Year	GDP growth %	GDP per capita growth (annual %)	Patent applications	Research and development expenditure (% of GDP)	Foreign direct investment (% of GDP)
2008	3.0867	1.58272525	6425	0.73548	3.62052
2009	7.86188	6.34085065	7262	0.72901	2.65159
2010	8.49759	7.02473248	8853	0.76713	1.63503
2011	5.24131	3.86969482	8841	0.8358	2.00207
2012	5.45639	4.13471779	9553	0.82217	1.31293
2013	6.38611	5.09669173	10669	0.81554	1.51628
2014	7.41023	6.14033404	12040	0.8674	1.69566
2015	7.99625	6.74270031	12579	0.84444	2.09212
2016	8.16953	6.93461141	13199	0.82213	1.94106
2017	7.16789	5.96681181	14961	0.83125	1.50774
Mean	6.72739	5.38338703	10438.2	0.80704	1.9975
Standard Deviation	1.69855	1.73704083	2734.99	0.04689	0.68611
Skewness	-1.167	-1.2762999	0.14979	-0.791	1.69039
Kurtosis	0.95296	1.27262668	-0.9116	-0.6281	3.02608

Source: World Bank Database

Model: This paper uses multi regression model to achieve the proposed objectives. The model used in the paper is as follows:

GDP growth rate = α + β(GDP per capita growth) + β(Patent) + β(R&D) + β(FDI)

The multi-collinearity test has been performed to identify the multi-collinearity among the variables. The correlation matrix for the model variables is presented in Table 2.

Table 2 Correlations

	GDP growth %	GDP per capita growth (annual %)	Patent applications	Research and development expenditure (% of GDP)	Foreign direct investment (% of GDP)
GDP growth %	1.000				
GDP per capita growth (annual %)	.998	1.000			
Patent applications	.512	.564	1.000		
Research and development expenditure (% of GDP)	.220	.274	.753	1.000	
Foreign direct investment (% of GDP)	-.492	-.524	-.603	-.671	1.000

The above table 2 shows the multicollinearity between two independent variables. This matrix explains multi collinearity between GDP growth % and GDP per capita growth and also between patents and R&D expenses. Table 2 shows the moderate positive correlation between GDP per capita which represents economic development of India and number of patents application which represents innovation in India. This analysis suggests that increase in per capital economic growth leads to motivate people for more innovations.

The strong positive correlation between patents and R&D expenses suggests that Indian economy gets stronger allocation of resources towards R&D Expenses can increase the innovation in India. Surprisingly, FDI however showed negative correlation with GDP growth, GDP per capita growth, Patents, and R&D Expenditure.

Table 3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000[a]	1.000	1.000	.02834

a. Predictors: (Constant), Foreign direct investment (% of GDP) , GDP per capita growth (annual %) , Patent applications , Research and development expenditure (% of GDP)

Table 4 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.962	4	6.490	8078.596	.000[b]
	Residual	.004	5	.001		
	Total	25.966	9			

a. Dependent Variable: GDP growth %

b. Predictors: (Constant), Foreign direct investment (% of GDP) , GDP per capita growth (annual %) , Patent applications , Research and development expenditure (% of GDP)

Table 5 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.177	.309		7.040	.001
	GDP per capita growth (annual %)	1.014	.008	1.037	132.029	.000
	Patent applications	-3.404E-005	.000	-.055	-5.328	.003
	Research and development expenditure (% of GDP)	-.716	.377	-.020	-1.901	.116
	Foreign direct investment (% of GDP)	.012	.021	.005	.587	.582

a. Dependent Variable: GDP growth %

Table 3 shows multiple R and R square which represents multiple correlation and coefficients of determination respectively. The R (1.00) explains that there is perfect correlation between dependent variable (GDP growth rate) and other independent variables used in the study. Lower P value shows the significance of the model. However negative coefficients represented in table 5 of the patent applications and Research & Development expenditure are surprising. That means if the Indian economy's economic growth rate will increase it will decrease the number of patent application filed and research and development expenditure in India. That seems unrealistic. Since the p-value is less than 0.05 ($p < 0.05$) as represented in table 4, this model is accepted, since lower P value indicates this model is significant.

Conclusion: For the economic growth and development of an economy, Innovation proves to be a key factor. Research and Development expenditure in the country and number of patents filed in India enhances the long term sustainable economic growth of the country. India is gradually increasing its innovative practices, however the growth in innovative practices is not as expected. There is still a long way ahead towards achievement of economic growth in the economy. To achieve this goal primary focus should be to increase spending on education and research and development activities, which ultimately will increase the productivity in near future. The results

obtained in this paper are not satisfactory. According to the results shown in the study, an increase in economic growth of the country will decrease the number of patents and also decrease the spending on Research and development activities of the economy. Hence the dream of sustainable economic growth is still questionable.

Like other studies, this study is also affected by some limitations, main limitation was non availability of the data. Also there are various vehicles which can be included in the study. These variables are not included due to non-availability of data

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IMPACT ON PROFITABILITY OF BANKS : A STUDY ON NON-PERFORMING ASSETS OF 21 PUBLIC SECTOR AND 19 PRIVATE SECTOR BANKS IN INDIA

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Abstract: *The problem of NPAs is not only affecting the banks but also the whole economy. In fact level of NPAs in Indian banks is nothing but a reflection of the state of health of the industry and trade. However lending also carries a risk called credit risk, which arises from the failure of borrower. Non-recovery of loans along with interest forms a major hurdle in the process of credit cycle. Though complete elimination of such losses is not possible, but banks can always aim to keep the losses at a low level. Granting of credit for economic activities is the prime duty of banking. Apart from raising resources through fresh deposits, borrowings and recycling of funds received back from borrowers constitute a major part of funding credit dispensation activity. These loans affect the bank's profitability on a large scale. Aim of the present research is to study the impact of NPA on profitability of banks, for this ratios on profitability and NPA of banks was calculated using the data of 10 years from the period of 2008-09 to 2017-18 published in the annual reports of 21 public banks and 19 private banks. It is found during the research that since 2013-14 all the banks whether Private or Public have witnessed a downturn trend. They all have been straddled with high NPAs and restructured assets. There is sudden rise in NPAs of banks from 2012-13 to 2017-18 and the profitability of the public as well as private banks have come down. This may be due to the fact that India had overcome the effects of global recession and this has led to increase in demand for loans and at the same time increased NPAs. It is concluded from the research that NPAs significantly affects the profitability of the banks and hence there is need to control it so as to improve the profitability.*

Keywords: Non-Performing Assets, Profitability, Return on Assets, Capital Adequacy, Public Banks, Private Banks

1.   Introduction: A strong banking sector is important for flourishing economy. The failure of the banking sector may have an adverse impact on other sectors. Non-performing assets are one of the major concerns for banks in India. NPAs reflect the performance of banks. A high level of NPAs suggests high probability of a large number of credit defaults that affect the profitability and net-worth of banks and also erodes the value of the asset. The NPA growth involves the necessity of provisions, which reduces the overall profits and shareholders' value.

The problem of NPAs is not only affecting the banks but also the whole economy. In fact level of NPAs in Indian banks is nothing but a reflection of the state of health of the industry and trade. However lending also carries a risk called credit risk, which arises from the failure of borrower. Non-recovery of loans along with interest forms a major hurdle in the process of credit

cycle. Though complete elimination of such losses is not possible, but banks can always aim to keep the losses at a low level.

1.1 NON PERFORMING ASSETS:

A **Non performing Assets (NPA) can be defined as**

1) An asset, including a leased asset, becomes non performing when it ceases to generate income for the bank.

2) A non performing asset (NPA) is a loan or an advance where;

- Interest and/ or installment of principal remain overdue for a period of more than 90 days in respect of a term loan,
- The account remains 'out of order' as indicated at paragraph 2.2 below, in respect of an Overdraft/Cash Credit (OD/CC),
- The bill remains overdue for a period of more than 90 days in the case of bills purchased and discounted,
- The installment of principal or interest thereon remains overdue for two crop seasons for short duration crops,
- The installment of principal or interest thereon remains overdue for one crop season for long duration crops,
- The amount of liquidity facility remains outstanding for more than 90 days, in respect of a securitization transaction undertaken in terms of guidelines on securitization dated February 1, 2006.
- In respect of derivative transactions, the overdue receivables representing positive mark-to-market value of a derivative contract, if these remain unpaid for a period of 90 days from the specified due date for payment.

3) Banks should, classify an account as NPA only if the interest due and charged during any quarter is not serviced fully within 90 days from the end of the quarter.

1.2 Categories of NPAs :-

Banks are required to classify nonperforming assets further into the following three categories based on the period for which the asset has remained nonperforming and the reliability of the dues:

        i. **Substandard Assets**
        ii. **Doubtful Assets**
        iii. **Loss Assets**

1) **Substandard Assets**

With effect from March 31, 2005, a substandard asset would be one, which has remained NPA for a period less than or equal to 12 months. Such an asset will have well defined credit weaknesses that jeopardise the liquidation of the debt and are characterized by the distinct possibility that the banks will sustain some loss, if deficiencies are not corrected.

2) **Doubtful Assets**

With effect from March 31, 2005, an asset would be classified as doubtful if it has remained in the substandard category for a period of 12 months. A loan classified as doubtful has all the weaknesses inherent in assets that were classified as sub-standard, with the added characteristic that the weaknesses make collection or liquidation in full, – on the basis of currently known facts, conditions and values – highly questionable and improbable.

This category are further classified as

D1 – When the account remains NPA for 3rd year.

D2 – When the account remains NPA for 4th and 5th year.

D3 – When the account remains NPA for 6th year onwards

3) **Loss Assets**

A loss asset is one where loss has been identified by the bank or internal or external auditors or the RBI inspection but the amount has not been written off wholly. In other words, such an asset is considered uncollectible and of such little value that its continuance as a bankable asset is not warranted although there may be some salvage or recovery value.

As per RBI guidelines provisions for NPA are to be made as under:-

a) 10% of sub-standard assets

b) 20% for doubtful assets

c) 100% for loss asset.

The problem of NPAs is not only affecting the banks but also the whole economy. In fact level of NPAs in Indian banks is nothing but a reflection of the state of health of the industry and trade. Granting of credit for economic activities is the prime duty of banking. Apart from raising resources through fresh deposits, borrowings and recycling of funds received back from borrowers constitute a major part of funding credit dispensation activity. These loans affect the bank's profitability on a large scale.

2. **Literature Review:**

According to **Chetan Dudhe (2017)** Non-performing Asset is a vital factor in the examination of financial performance of a bank. Banks today are not judged only on the basis of number of branches and volume of deposits but also on the basis of standard of assets. NPAs negatively affect on the profitability, liquidity and solvency of the banks. In his paper he analyses the circumstances of NPAs in selected banks namely State Bank of India (SBI),Bank of India, United Bank of India, Bank of Baroda, Indian Overseas Bank, Punjab National Bank and Central Bank India. The paper also highlights the policies followed by the banks to tackle the NPAs and suggests a multi-pronged strategy for speedy recovery of NPAs in banking sector. Seven Public Sector Banks has been selected for the study the relation between Gross NPA and Net Profit of seven banks. He applied the panel regression in his paper. The result of his paper shows that

except for SBI and PNB all the other banks exhibit a negative correlation between their gross Non Performing Assets and net profits. But SBI and PNB is increased the net profit every year not affected by Gross Non Performing Assets. Both banks are paying attention towards their NPA to recover their pending loans. His study is based upon secondary data recovered from Report of Progress of banking in India, Websites, Journals and Articles. The scope of the study is limited to analysis of nonperforming assets of public sector banks covering the period of 2007-2016.

Sri Aryan Chakraborty (2017) in his paper states according to SARFAESI 2002, NPA is an asset or account of a borrower, which is classified by a bank or financial institution as sub-standard asset, doubtful asset and loss asset. Indian banks with enormous amounts of bad loans are in pathetic health and witnessed a sharp jump in their gross NPAs. He found that at international level Indian banks are among the banks that have higher percentage of NPAs. The objective of his study was to perform an analysis of Non Performing Assets of 5 leading Indian Commercial Banks and their effect on Banks profitability. He concluded that the selected Commercial Bank is different in terms of total assets, Gross and Net NPAs, Advances and efficiency factors. Differences exist in their mean value of Return on Assets, Gross NPA/Total Assets, Net NPA/Total Assets & Net NPA to Advances.

Swamy (2001) studied the comparative performance of different bank groups since 1995-96 to 1999-2000. An attempt was made by researcher to identify factors which could have led to changes in the position of individual banks in terms of their share in the overall banking industry. He analyzed the share of rural branches , average branch size, trends in bank's profitability, share of public sector assets, share of wages in expenditure, provision and contingencies, net non performance assets in net advances, spread, has been calculated. He concluded that in many respects nationalized public sectors banks much better than private banks, even they are better than foreign banks.

Rituparna Das (2002) performed a research to seek a solution to the problem of NPA in the small scale industries under the present circumstances of banking and insurance working together under the same roof. What is stressed in this article is the pressing need of the small-scale entrepreneur for becoming aware and educated in modern business management holding a professional attitude toward rational decision-making and banks have to facilitate that process as a part of the credit policy sold by them.

3.   Research Methodology: Aim of the present research is to study the impact of NPA on profitability of banks, for this ratios on profitability and NPA of banks was calculated using the

data of 10 years from the period of 2008-09 to 2017-18 published in the annual reports of 21 public banks and 19 private banks. The objectives of the study are:

- To study the level of NPA to loans and advances of Public as well as private banks
- To analyze profitability of Public sector banks and Private sector banks.
- To study the impact of NPA on profitability of banks.

On the basis of the objectives, the following hypothesis was framed:

Ho: *There is no significant relationship between level of NPA's and Profitability of Banks*

H1: *There is significant relationship between level of NPA's and Profitability of Banks*

4.   Data Analysis: To study the impact of NPA on profitability of the banks following ratios are calculated from the annual reports of 21 public banks and 19 private banks:

a. **Capital Adequacy Ratio:** It is the ratio which measures the bank's risk of insolvency from excessive losses. It also measures the ability of bank to meet its obligations by comparing its capital to its assets. In the present study the average CAR from the period of 2008-09 to 2017-18 is computed from the data available in annual reports of banks.

b. **Return on Assets:** This ratio is an indicator of profitable a bank is relative to its total assets. The formula used in this research to calculate ROA is:
Profit after Tax/Total Assets

c. **Return on Equity:** This ratio measures the ability of the bank to generate profits from its shareholders investment. This ratio is calculated by using the following formula:
Profit after Tax/Shareholder's Equity

d. **Net Profit Margin:** This ratio indicates the percentage of revenue left after deducting all the expenses from revenue from operations of bank. It is calculated as follows:
*(Profit after Tax/Revenue from operations)*100*

e. **Operating Expenses Ratio:**This ratio shows how efficient a bank's management is as it compares the total operating expense of a bank to its net revenue from operations. The operating ratio shows how efficient a company's management is at keeping costs low while generating revenue. The formula to calculate this ratio is:
*(Operating expenses/Revenue from operations)*100*

f. **NPA to loans and Advances Ratio:** The net NPA to loans (advances) ratio is used as a measure of the overall quality of the bank's loan book. Net NPAs are calculated by

reducing cumulative balance of provisions outstanding at a period end from gross NPAs.

Higher ratio reflects rising bad quality of loans. The Ratio is calculated as follows:

Net NPA/Loans and Advances

The average of all the ratios from 2008-09 to 2017-18 is computed and the results obtained are shows in Table 1 below

Sr. No.	Type of Bank	Name of Bank	Capital Adequacy Ratio	Return on Assets	Return on Equity	Net Profit Margin	Operating expenses Ratio	NPA to Loan Advances Ratio
1	Public	Allahabad Bank	11.512	1.6175	2.789	10.662	10.869	37.530
2	Public	Andhra Bank	12.284	0.569	9.136	5.797	16.903	3.079
3	Public	Bank of Baroda	13.425	0.541	10.24	7.93	19.886	1.648
4	Public	Bank of India	11.888	0.711	9.512	3.432	18.726	2.676
5	Public	Bank of Maharashtra	11.931	0.229	5.12	2.368	20.932	4.068
6	Public	Canara Bank	12.742	0.575	9.3	6.656	16.429	3.069
7	Public	Central Bank of India	11.203	-0.059	-0.525	-1.19	22.025	4.459
8	Public	Corporation Bank	12.227	0.442	7.062	5.125	14.344	3.512
9	Public	Dena Bank	11.641	0.242	6.467	2.728	18.913	4.11
10	Public	Indian Bank	13.169	0.988	12.76	11.678	18.781	2.169
11	Public	Indian Overseas Bank	11.8	-0.148	-2.921	-3.347	19.753	5.898
12	Public	Oriental Bank of Commerce	12.242	0.562	7.634	0.763	14.797	2.979
13	Public	Punjab National Bank	12.609	0.826	13.41	3.609	22.32	2.939
14	Public	Punjab & Sind Bank	12.237	0.679	11.656	4.701	15.144	2.399
15	Public	Syndicate Bank	12.021	0.476	10.01	3.596	17.061	1.865
16	Public	Union Bank of India	11.791	0.67	11.401	4.226	17.397	2.268
17	Public	United Bank of India	11.632	0.121	1.796	0.444	18.022	4.289
18	Public	UCO Bank	12.178	0.154	3.031	1.054	14.922	3.601
19	Public	Vijaya Bank	6.3975	5.464	7.481	10.687	9.392	35.123
20	Public	IDBI Bank Ltd	12.199	0.136	3.706	-3.562	12.797	3.284
21	Public	State Bank of India	12.967	0.65	10.65	8.512	24.181	2.848
1	Private	AXIS Bank Ltd.	15.077	1.418	15.56	16.899	24.605	0.903
2	Private	Citi Union Bank Ltd.	14.461	1.539	19.17	16.038	16.706	1.072
3	Private	Nainital Bank	14.534	1.379	15.83	14.747	26.564	0.23
4	Private	DCB Bank Limited	14.342	0.505	5.36	5.015	30.882	1.345
5	Private	Dhanlaxmi Bank Ltd	7.987	-0.283	-5.698	-2.676	29.18	2.168
6	Private	ICICI Bank Ltd	17.891	1.391	10.66	18.144	22.884	2.258
7	Private	IndusInd Bank Ltd.	14.474	1.548	16.197	16.167	24.401	0.44
8	Private	Karnataka Bank Ltd.	12.822	0.784	11.31	8.246	19.254	1.937
9	Private	Kotak Mahindra Bank Ltd.	17.918	1.64	12.83	17.603	29.429	1.141

10	Private	RBL Bank.	27.667	1.105	7.431	8.356	22.603	0.512
11	Private	Tamilnad Mercantile Bank Ltd.	14.802	1.414	15.10	3.651	21.918	0.686
12	Private	The Catholic Syrian Bank Ltd.	11.361	0.079	1.749	1.052	20.571	2.552
13	Private	The Federal Bank Ltd.	16.612	1.2	11.57	10.453	17.903	0.751
14	Private	The HDFC Bank Ltd.	15.921	1.717	18.38	19.266	21.399	0.311
15	Private	The Jammu & Kashmir Bank Ltd.	13.095	0.853	12.30	7.752	16.162	1.539
16	Private	The Karur Vysya Bank Ltd.	13.706	1.278	16.58	8.962	18.165	0.57
17	Private	The Lakshmi Vilas Bank Ltd.	11.974	0.38	5.916	2.88	18.503	2.02
18	Private	Yes Bank Ltd.	16.7	1.655	21.38	16.135	15.328	0.184
19	Private	The south Indian Bank Ltd.	13.449	0.919	14.83	7.893	15.435	0.928

Source: Annual reports of respective banks

Table 1 shows that on the basis of performance and profitability, public banks like State Bank of India, Allahabad Bank, Andhra Bank, Bank of Baroda, Bank of India, Indian Bank, Oriental Bank and Union Bank of India have outperformed other public banks. However, Allahabad bank have the highest average NPA to loan and advances ratio of 37.53, followed by Vijay Bank 35.123. In case of private banks The South Indian Bank, Yes Bank, The HDFC Bank, Karnataka Bank, IndusInd Bank, ICICI Bank and Axis bank have greater profitability than other private banks.

5.   Testing: To test the hypothesis i.e. "There is no significant relationship between level of NPA's and Profitability of Banks" One Way ANOVA test is applied using SPSS tool taking average net profit margin of all the 40 banks as dependent variable and average NPA ratio as fixed factor, where following results are obtained:

Table 2 Descriptive Statistics

	Mean	Std. Deviation	N
Net Profit Margin	6.7093	10.08817	400
NPA to Loan Advances Ratio	2.1950	2.59932	400

Table 2 shows the mean Net profit ratio of 6.7% and NPA to loan & Advances Ratio of 2.195% of all the 40 banks over the period of 10 years.

Table 3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873	.763	.580	6.53481

a. Predictors: (Constant), NPA to Loan Advances Ratio

From the table 3 the R square value obtained is .763 and adjusted R square value is 0.581 and this enlighten us that the model account for 58.1% of variance in the present study. This is the clear indication that this model is a semi strong model. Also the R value is 0.763 which states

that there is **strong relationship** between change in NPA to loans and advances ratio and Profitability of Banks. This proves that NPA affects the profitability of banks.

Table 4 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23610.610	1	23610.610	552.893	.000[b]
	Residual	16996.089	398	42.704		
	Total	40606.699	399			

a. Dependent Variable: Net Profit Margin
b. Predictors: (Constant), NPA to Loan Advances Ratio

The above table shows the F value of 552.893 and sig. value (p value) of 0.00 calculated from the difference between the mean values. Since the p value calculated above is less than the alpha value of 0.05, it is concluded that there is significant relationship between level of NPA's and Profitability of Banks. Hence on the basis of means and ANOVA calculated it is concluded that the hypothesis i.e. There is no significant relationship between level of NPA's and Profitability of Banks is **rejected** and alternate hypotheses i.e. there is significant relationship between level of NPA's and Profitability of Banks is **accepted**.

6.   Findings: It is found during the research that since 2013-14 all the banks whether Private or Public have witnessed a downturn trend. They all have been straddled with high NPAs and restructured assets. There is sudden rise in NPAs of banks from 2012-13 and continued to increase till 2017-18 and the profitability of the public as well as private banks have come down. This may be due to the fact that India had overcome the effects of global recession and this has led to increase in demand for loans and at the same time increased NPAs.

The volume of Net NPA witnessed a wide fluctuation during the period of ten years starting from 2008-09. However, major changes were observed from 2012-13 to 2017-18. The decline in advances was accompanied by the growth in gross NPA as well as Net NPA.

Due to decrease in profitability of majority of banks, Return on assets and Return on Equity of the banks was directly affected and hence decreased considerably after 2013-14 and this continued to decrease up to 2017-18. Net NPA % has impacted significantly on Return on Assets and Return on Equity. NPA has affected the profitability of the organization in terms of rising cost of capital, increasing risk and hence affecting the liquidity of the banks.

7.   Conclusions: The most threatening issue faced by banking sector in the current scenario is Non Performing Assets (NPAs). However, the level of NPAs can be reduced through an efficient monetary mechanism and also by applying various controlling measures. The liquidity, profitability, overall quality of the assets and the successful survival of the banks is directly affected due to NPAs. There is harmful effect on the profitability of the banks due to huge rates on NPAs in both public and private banks.

Increase in the level of NPA has led to reduction in income from interest, erosion of the capital base and also reduction in its competitiveness, decrease in profits as well as reduction in reserves and provisions that come from profits. Since all these factors act as a cushion for loan losses. Hence, management of NPAs has a vital role in strengthening of Indian Banking sector as well as Indian Economy.

8.   Recommendation: Incremental gross NPA ratio describes the current performance of a bank regarding NPA management; hence it is recommended that the regulating authorities should pay more attention to incremental gross NPA ratio rather than gross NPA ratio. Disclosure of this ratio be made mandatory by regulating authorities to the banks.

Investors normally use the information contained in financial statement of the bank for taking their economic decisions about the bank. Investors also analyze the financial position and financial performance of the bank of the basis of such financial statement. Hence it is recommended to the regulating authorities that there should be some information about NPA under the section 'notes to the financial statement'.

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IMPACT OF DEMONETIZATION ON INDIAN ECONOMY

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ABSTRACT: The day of 8th November, 2016 had brought a shocking surprise for Indian people, on this day the Indian government promulgated that at the end of midnight all banknotes of Rs. 500 and Rs.1000 would remain not legal currency in India. At one throw, approximately 87 percent of all the currency in circulation in whole India which amounts to Rs. 15 lakh crores was became just a useless piece of paper which had no meaning and no purchasing power. The government of India had guaranteed the Indian citizen that this step would not only be helpful in termination of black money problem, it would also provide wretched the counterfeit banknotes distributing in Indian economy which were being used to feed terrorism and other criminal activities. The reverberation of the demonetization was that there were very long waiting lines outside the banks and ATMs, the people in queue were attempting to exchange their old banknotes for the new ones and that were also to a maximum limit of Rs. 4000 only at a single time because there were not sufficient banknotes had been printed before the declaration of this decision. ATMs were run out of currency; people were remained with no money to spend on their expenses. There was a beckon of perturbation all around in the country could be evidenced. This change was coined as 'SURGICAL STRIKE ON BLACK MONEY'. The awkward execution of this decision made a spoof of the initial stupor and reverence. Some people were rhapsodized this resolution of government of India whereas other people called it poorly managed activity. The author in this paper tried to discuss the effect of Demonetization on diverse sectors like retail and banking, manufacturing, infrastructure, agriculture etc. of the Indian economy and whether the demonetization leads to success or failure.

KEYWORDS: Indian economy, Demonetization, Black Money, Various sectors.

- **INTRODUCION**

Demonetization is a process of devastate a particular currency of its status as legal tender. It occurs only when there is a need to change of national currency. The current form of banknotes is revoked from distribution and is to be replaced with new notes or coins. Sometimes, a country exchanged the old banknotes with new currency. Demonetization is a procedure in which a certain currency is revoked and in place of that currency new currency arrives in existence for circulation in country. The decision of demonetization will have taken in any economy whenever there is a need to change in the currency of any nation, drag out the old banknotes from circulation and restore the economy with new banknotes.

- **DEMONETIZATION IN INDIA**

  It was not the first time when the Indian citizen witnessed the beckon of currency from the distribution. Indian had done two times demonetization in its history. One and half year before the independence of our country in January 1946, the first time currency prohibition was took place in India at that time Rs. 1000, Rs. 5000 and Rs. 10,000 were beckoned from the circulation for the intention to muzzle the problem of black money transactions. This first time demonetization had no impact on Indian economy because the banknotes of higher denomination were not approachable by common people and it was nearly 12% of the total Indian currency in distribution.

  In year 1954, all the notes of denomination of 1000, 5000 and 10,000 were launched again. In January 1978, janta party association government adjudicated that the banknotes of Rs. 1000, Rs. 5000 and Rs. 10,000 were not legal to fighting with the problem of black money and counterfeit currency. At that time only 0.9% of the banknotes in the whole economy were demonetized. Central board of direct taxes examined this new movement and its report came to a result that this movement was not so effective because approximately 14.8% of the total currency was swapped.

  The citizen who had money of higher denomination doesn't arrive for this exchange because they had a fear of penalty by the government. The report of CSDT said that in this phase of economy demonetization was not admonition because black money was held with larger part of population in the form of benami transactions, jewellery and precious metals. This movement would increase the cost of printing banknotes because a no. of banknotes was printed.

- **2016: DEMONETIZATION**

  On 8th November, 2016, the government of India announced that the banknotes of Rs.500 and Rs. 1000 were demonetized. The Prime Minister Narendera Modi plunders the status of banknotes of higher denomination viz. Rs. 500 & Rs. 1000 as legal tender. This step collected a sum of almost 15 trillion from the whole economy. This movement had an objective to solve the problems of black money, corruption and terrorism. As the time passed, the more aim were summed up in this step such as formation of cashless economy, broadening the taxpayer base.

  The people of country were allowed to deposit the demonetized currency in their bank accounts up to 30 December, 2016. There was a provision that anyone can withdraw money from their account up to Rs. 4000 at a single time. The government of India permitted the demonetized bank notes at government hospitals, for the purchase of diesel, petrol and CNG, for the buying of airline, railway and government bus tickets, at consumer cooperative stores authorized by central or state government and at milk booths.

  Non- cash payments like payments through cheques, demand drafts, debit or credit cards, electronic fund transfers, demand drafts etc. were allowed. New banknotes of denomination of Rs. 500 and Rs. 2000 were launched in the economy.

- **LITERATURE REVIEW**

Antony et al, (2017) had studied the effect of demonetization on banks and alleged that there were some effects of demonetization viz. a reduction in asset quality, in demand of credit, in profitability and increase in deposit base. The author supported his findings with tables showing gross NPA and net NPA of many banks in September 2016 and December 2016, demand for credit in MSME and agriculture sector in September 2016 and December 2016, current savings and term deposits in many banks in September 2016 and December 2016, resolved that demonetization brought the enough money in hands of banks but in enhanced the quantity of stressed assets which negatively effects the goodwill of banks.

Sarkar and Dutta (2017) examined the impact of demonetization on healthcare and pharmaceutical industry and concluded that generally the impact of demonetization on healthcare and pharmaceutical sectors were significantly high in starting days but as the time passed on the apparent impacts were shown. They also examined the correlation between healthcare sector and overall market and found it to be quite high. They suggested health insurance can be a policy to fight such uncertainties in near future.

Rastogi (2018) had studied demonetization, reasons behind the decision and its effect on Indian economy, the effect of demonetization on black money, India's economic growth, note bank politics, terrorist activities, stock market and cashless economy, fake currency, showed the status of currency in distribution before and after demonetization. They concluded that demonetization was implemented on the perfect time as economy was growing nice at that time and it could captivate the short term shocks easily.

Singh (2017) discussed the impact of demonetization on digitalization of Indian economy. He discussed about many projects started by government of India for the digitization like Bharat Net, Digital India, and DigiGaon. The author conclude that digitalization decrease the risk of tax evasion, increase the tax base and control the black economy in many aspects and also implied that there should be improvement in digital infrastructure especially in rural areas.

Sarkodie (2018) examined the demonetization and the poor level of the society. He described that his study organized on labour class of lovely professional university campus through formal and informal interactivity. The author had also showed the effect of demonetization on various economies of world and the reason of their failure. The author concluded that however the demonetization was a significant movement but it did not eliminate black money purely and also negatively affected the poor people.

- **OBJECTIVES**
- ✓ To study whether the government's aim behind demonetization has been achieved or not.
- ✓ To study the effect of demonetization on many key sectors of Indian economy.

- **RESEARCH METHODOLOGY**

  The secondary data is used in this paper. The whole paper is descriptive in nature. The data is collected from many sources like research papers, websites, articles journals, magazines etc.

- **IMPACT OF DEMONETIZATION**

  The effects of demonetization across diverse sectors are as follows:

❖ **DEMONETISATION AND ITS IMPACT ON HOUSEHOLDS**:

Consumers were spending selectively on mandatory needs. The funny concept in Indian culture is that females in villages and towns had a habit to keep their saved money hidden from their husbands and other family members for any kind of emergency in future in the family. Now because of demonetization these housewives had to disclose their hidden saved money to their husbands as it was of no worth until interchanged. Some housewives were humiliated by their spouse and family members on revealing their hidden money. This unpredicted step of invalidating the banknotes was no less than a slap on these housewives and their personal savings.

❖ **CASH CRUNCH:**

Demonetization created remarkable decrease in liquidity in short run. There was a keen decrease in the availability of income with the people that impacted their spending habits and consumption trends in the economy of India in short run. The demand for real estate and property, gold and luxury goods, consumer goods, automobiles were affected mostly.

❖ **DEMONETISATION AND ITS IMPACT ON AGRICULTURE SECTOR:**

The government of India publicized demonetization in November 2016 that was the harvest time and farmers were dealing in money. They found problems in sowing Rabi crops due to not availability of money that they needed for buying necessary things. Producers of Kharif crops were not able to sell their produce due to the cash crunch. So, they had to sell their crops at lower rate which was a big loss for farmers.

❖ **DEMONETISATION AND ITS IMPACT ON STOCK MARKET:**

The market in a few days showed the impact of demonetization and market jumped 1689 points with BSE going down at 26,000 marks to be at 25,902 while NSE slipping down 541 points to be at 8,002. After some time market regained its powerful position to close at points of 29,910 on BSE and 9,237 on NSE on 3 April, 2017. Even more BSE closed at ever high record at 34,592.39 and NSE at 10,681 on 12 January, 2018. So conclusion is that overall market situation is bullish and the timing of demonetization was nicely adopted by the stock market.

❖ **DEMONETISATION AND ITS IMPACT ON BANKING SECTOR:**

The Public Sector Banks were largely benefited from demonetization policy. The outcome of demonetization was increase in deposits from which banks can invest money for increasing their liquidity, improving digital coherence. At that time the numbers of account holders were increased. Private sector banks found no instant increase and after demonetization period there was decline.

Large customer base of PSBs in rural areas gave a benefit to these banks as compared to their private competitors. Public sector banks have thrice number of branches as compared to other private banks in the whole country. Public sector banks had observed high deposits with 69.50% of Jan Dhanyojna accounts, striking a downward pressure on the cost of money. This advantageous effect was showed in the price movements of Public Sector Banks.

❖ **DEMONETISATION AND ITS IMPACT ON ALTERNATIVE PAYMENT METHODS:**

Demonetization resulted in the evolution of electronic transactions. Transactions through electronic method were increased in December and January, over the following months these were steady down. A report of bankers told that If on an average 100 transactions were occurring before demonetization, then after scrapping the legal status of banknotes it was bloom up to 300, which now has settled down around 200 or 210 levels. Demonetization resulted in grasping the larger portion of money in distribution in whole economy; the citizens were willingly or unwillingly made to adopt the way of electronic payments.

❖ **DEMONETISATION AND ITS IMPACT ON RETAIL SECTOR:**

The step of demonetization had an immediate positive and negative impact on the economy, so it is important to study the effect on retail sector because it depends on cash mainly. The small businessmen experienced more difficulty and unstructured retailing shops like local kiranas, handcraft vendors, general stores managed by its owner, convenience stores, as comparative to the structured retailers like Big Bazaar, Reliance retail etc. This Impact was of short term but enormous. Big retailers adopted to cashless methods of making and receiving payments through digital payments and small retailers had no facility of digital transaction method like online payments, swiping machine. So the sales of small retailers were go down largely.

❖ **DEMONETISATION AND ITS IMPACT ON POOR CLASS OF THE SOCIETY:**

The instant effect of demonetization on rural class and weaker sections of economy was no less than a torment because poor people depend mainly on money. They are daily wage workers who were forced to waste plenty of their time in long waiting lines before banks that were inadequate and before ATMs. On those days ATMs were run out of cash within few hours. All that was on the cost of losing their wages.

They had not any work for many days because their employers had not sufficient cash for paying them. Poor families suffered for many days. Some people had to walk 5-10 kilo meters daily to

go to the nearest bank for exchange their small amount of money. They had to experience the burden of stress. It was not certain that they could get the new banknotes surely.

They also nervous about what would happen if they came late in the queue and not get the new banknotes in place of their old ones and how will they feed their families. Poor people could not withdraw their money when they needed urgently. Family functions and Marriages had to be postponed. At the same time when some poor were facing problems, some poor had jackpot because mostly rich people made these poor people to stand in the waiting lines for money. Poor people were paid for standing in long waiting line for hours. Some other people got bonanza offer by getting an opportunity to open Jan Dhanyojana accounts. It works as a gateway for extra money that the rich people had.

❖ **DEMONETISATION AND ITS IMPACT ON AUTOMOBILE SECTOR:**

 Demonetization resulted in decrease of automobile sales. Automobile demand was smashed badly by invalidation of high value banknotes. The demand was smashed to 18.17% including the total sales of two wheelers, cars and commercial vehicles. It was the very sharp downfall since 2000. Vehicles sale from all categories were reduced to 1221929 units from 1502314 units in December 2015. Sales of scooters are deemed to be popular in urban markets; this sector also experienced the largest decrease in more than 15 years i.e. declining from 26.4% to 284384 units in December 2016 (data showed by the Society of Indian Automobiles Manufacturers, SIAM).

❖ **DEMONETISATION AND ITS IMPACT ON GDP:**

Demonetization worked like a liquidity crunch stupor that created disruption in economic activities of the country. It created a sudden disintegration in commercial ecosystem of the country; trading in all the aspects was disturbed. At that time India almost lost its status of the speedily emerging major economy in the world. Decrease in production, consumption, income, employment, investment reduced GDP growth of country. Hardly five to six months after demonetization, had India's GDP growth rate dropped down to 6 % in January –March time period, which was lowest in more than two years. Evermore in July 2017, it went down to 5.6 %.

❖ **DEMONETISATION AND ITS IMPACT ON POLITICS IN INDIA:**

The Political effect of demonetization was obviously large everywhere in the country because many people were supported to this step. The emotional deliverance against the problem of black money made by prime minister to get attention of immense crowd by changing them into vote banks for Bharatiya Janata Party, so it could be seen that BJP won elections in the states like Uttarakhand, Uttar Pradesh, Tripura, Himachal Pradesh etc. It could be seen that educated people and specially the youth were supporting BJP for such a bold move to stop black money. But as usual opposition parties were opposed the demonetization move. The ever quiet ex-prime minister, the economist said this step was a "monumental mismanagement" and "organized loot

and legalized plunder". Opposition parties were very strongly opposed the implementation process of demonetization.

- ❖ **DEMONETISATION AND ITS IMPACT ON TERRORISM AND COUNTERFEIT FAKE BANKNOTES:**
Demonetization had a positive impact on terrorism and counterfeit banknotes. After November, 2016 there was decline in terrorism but as time passed by, terrorism started to emerge again because the newly launched banknotes started to circulate largely in the economy. Even just within two and half months, there was news of fake currency notes of Rs. 2,000 were being circulated in the economy.

The Income Tax Department of India declared that it had grabbed Rs. 5 billion in unaccounted money from some people accumulated cash that they could not explain its source. Almost Rs. 920 million of their seizure emerged to be in new Rs. 2,000 banknotes. The Cases of dishonest officials like some politicians, government officers, bank managers, being snatched red handed in non legal transactions were reported, all of which included the new banknotes. However, this could have been avoided by entrapping strong security measures within economy. Demonetization achieved favorable results in short term but in long time period, it was not achieved success. The government had to launch strict policies to achieve the key objectives.

- ❖ **DEMONETISATION AND ITS IMPACT ON DIGITIZATION OF THE ECONOMY**
The citizen of country had to adopt electronic modes of transaction because almost 87% of the banknotes were become invalid. The data provided by the government agencies revealed that the number of daily transactions through electronic payment services like bhimupi, Paytm, MobiKwik go up from 16.95 lakhs showed on 8 November,2016, but at that time when demonetization was introduced then it go to 63.5 lakhs on 7 December, 2016, record an improvement of 270 %. The Government of India had to introduce some applications like SBI Buddy, UPI, Aadhaar Pay, BHIM, Tez etc. for doing electronic payments.

These endeavor had providing results showing 964 million digital transactions marked in October 2017. The number of banks had seen 20-30% shot up in electronic transactions. It can be inferred that demonetization got success in providing digital push to the Indian economy but only this move is not enough because India yet had 22% of the population who do not have any bank account, even more 1.3 billion citizen had not use to the internet service and 3.5 billion people had no mobile phones. There are shocking inadequacy in cyber safety and security system. The government of India provides lowest broad-band speed for internet. One third of total population of India had no genuine electricity sources. The government of India needs to shoot up its digital setup for completely attaining its aims.

❖ **DEMONETISATION A SUCCESS OR FAILURE IN INDIA**

When government of India introduced demonetization, it declared the succeeding objectives for introducing this new step in the economy:

1. To remove the problem black money and corruption.

2. To flush out fake Indian currency notes from the economy.

3. To attack at the origin of providing finance of terrorism.

4. To change informal economy into a formal economy to increase tax base structure and increase employment opportunities.

5. To provide an enhancement to digitalization of transactions to build India as a paperless and cashless economy in the world.

The country that largely depends on cash, all the money is not black money and mostly people do not store black money in the form of cash. Most of India's black money had been infused in real estate business and some different forms of property, jewellery, and precious metal, investments in property situated in foreign countries, in Swiss Banks and some other foreign banks. The Govt. was expecting that this unanticipated step would removed a large chunk of black money because it supposed that black money possessor would smash their hidden money in spite of divulging it banks and tax authorities.

The government of India had determined that approximately 20-24% of currency would not have been deposited by public till the specified dates. But some people who were possessing large amount of black money appeared to be more inventive than the government of India because they had found escaping way in this newly introduced system and exchanged black money into white money by adopting some methods like opening new accounts on the names of those family members who don't had a bank account, on the names of their servants, on the name of some poor people of their known etc. and then depositing their hidden black money in those account.

These activities showed result that around 97-98% of the banknotes in circulation had deposited into banks. So the activities of people showing that corruption is like a way of living and enjoying life in India, hence only single activity such as demonetization is not sufficient to flush out completely the black money and corruption in India. There should be continuous, Sustained and long term attempts and their proper execution are necessitated and also their performance should be measured by the government of India to attain these specified objectives.

• **CONCLUSION**

 It had been around two years and three months since the government of India announced the new move in the economy as demonetization for flush out the problem of black money, fake banknotes and to eradicate the sources who were feeding terrorism. But contradictory to Govt. expectation, approximately 95 % of invalid banknotes came back into accounts.

Major part of our population had big chunks of black money in the form of cash. They got loopholes in the system and invent many innovative ideas for distributing their black money in to

smaller parts and new money in the exchange of their old one. So, black money was also exchanged and became legal white money in the period of demonetization. Hence the step which was assumed to eradicate black money from the whole economy was assist people change their black money as white money. It was just a change in its appearance in the economy.

Demonetization had not affect many corrupt people because it was founded that a minister spent Rs. 500 crore on the wedding of his daughter after the demonetization step. After some months, it was clearly seen that demonetization had not attain its key objectives of black money and fake currency notes. So, the government of India introduced a third objective to emerge India as a cashless economy.

This new objective of cashless economy was surely a very generous objective, but at what cost? At that time cashless were those poor Indians who completely depend on cash for their routine needs.

The Govt. played a game of changing objectives and then improvement in the income tax base had also been introduced as other objective of demonetization. There had been a slight increase in direct tax collection but yet it had not rationalize the devastating effect that demonetization had on economic system of India. The entire disturbance was unshackled in the demonetization; it could have been avoided, if and only if the government of India had done some work on it before introducing this new step. It was an autocratic policy. There was no any policy framework, no profit-cost analysis, and no alternative policy options. Demonetization failed in its declared objectives because it was non formulated, non implemented step, not-planned properly, and dreadfully executed.

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DETERMINANTS OF CAPITAL STRUCTURE IN DPSUS (GRSE &HAL)IN INDIA

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1.0 Introduction

The capacity of a firm to operate its activities is based on the availability of funds. Normally, these funds in finance literature are termed as long term funds, which are contributed by owners (shareholders) and outsiders. The owners'funds are represented by equity contributions and internally generated financial resources. A unique characteristic of procuring funds is that a firm may tap any of these sources and hence the blend of these different sources of long term funds is termed as capital structure in finance literature. Capital structure ordinarily implies the proportion of debt and equity in the total capital of a firm. In the term, capital structure,' capital refers to long term funds and structure refers to the proportion of debt and equity in capital. Further, capital is easily comprehended through accounting as the difference between total assets and current liabilities, and this residual difference is always represented by debt and equity.

This capital is supplied by long and short term borrowings, the sole of preferred and common stock and the reinvestment of earnings. He further states that, in analyzing the capital structure of an enterprise, short term debt is often excluded from considerations'. Many others include only long term sources of funds under the capital structure.

In this article, an attempt has been made to bring out the various determinants of Capital Structure of DPSUs in India. In the post liberalization and disinvestment era, the PSUs in India have become more market oriented on raising funds. The slow reduction in the budgetary support for the PSUs has become is notable factor for the PSUs. The PSUs depend more on extra-budgetary resources (EBR) for their requirements. The variables are considered keeping in view the established Capital Structure models like (i) Trade off Theory and (ii) Pecking Order Theory.

(i) Trade off Theory: The Companies have the options to trade off costs against the cost and benefit to arrive at decisions for availing borrowed funds. As per this theory, companies with stable and tangible assets will go for higher debts and vice versa.

(ii) Pecking Order Theory: As per this theory, there is a pecking order of financing under which internal financing, debt financing and equity financing are preferred in that order. The internal equity is kept at the top and the external equity at the bottom. It explains why highly profitable companies borrow less and less profitable companies borrow more.

The factors those determine the Capital structure decisions of a company generally are financial risk, operating risk, debt servicing capacity, profitability, sizes etc which are explained below.

(i) Financial Leverage (FL): This ratio is used to calculate the financial leverage of a company to get an idea to measure its ability to meet financial obligations. There are several ratios, but the main factors looked at include debt, equity, assets and interest expenses. Generally money is borrowed for enhancement production and sales which ultimately yield in rising earnings. It is measured through the ratio of total debt to total assets. The higher the amount of debt, the higher the financial leverage. Since interest is a fixed cost (which can be written off against revenue), a loan allows an organization to generate more earnings without a corresponding increase in the equity capital requiring increased dividend payments (which cannot be written off against the earnings). However, while high leverage may be beneficial in boom periods, it may cause serious cash flow problems in recessionary period

(ii) Operating Leverage (OL): The ratio indicates the proportion between the contributions to operating profit of a business. The comparison is made between the gross margins with the EBIT of the business. A business which has a higher proportion of fixed costs and a lower proportion of variable costs is said to have used more operating leverage. Those Companies which have lower fixed costs and higher variable costs are said to employ less operating leverage and vice versa.

(iii) Gross Interest Coverage Ratio (GICR):

A measure of a company's ability to meet its financial obligations. In broad terms, the higher the coverage ratio, the better the ability of the enterprise to fulfill its obligations to its lenders. The trend of coverage ratios over time is also studied by analysts and investors to ascertain the change in a company's financial position. Common coverage ratios include the interest coverage ratio, debt service coverage ratio and the asset coverage ratio. This ratio is used to assess a company's financial affordability by examining whether it is at least profitable enough to pay off its interest expenses. A ratio greater than 1 indicates that the company has more than enough interest coverage to pay off its interest expenses. The ratio is calculated as EBITDA/Interest payments

(iv) Net worth: The book value of a company is its net worth which represents the total assets minus the total liabilities. This shows how much the company gets, if it is sold out.

(v) Sales: It is the Revenue earned by the companies both from sale of goods and services. The sales reflect the growth in size of a company. The more the sales, there will be inflow of more funds which will affect the financial structure of the company.

An attempt has been made to study the impact of certain variables like financial leverage, operating leverage, debt servicing Capacity, profitability and size on the Capital structure decisions represented by the debt equity ratio DPSU wise as given below.

1.3.5 Determinants of Capital Structure of GRSE

The impact of variables like financial leverage, operating leverage, debt servicing Capacity, profitability and size on the Capital structure decisions of the Company is given below.

Table 1.1

Determinants of capital structure of GRSE

Year	DE	FL	OL	GICR	NW	Sales
2002-03	9.28	0.90	-4.37	95.28	26608	15047
2003-04	8.27	0.89	1.51	0.00	28389	38695
2004-05	7.24	0.88	12.35	0.00	29903	87644
2005-06	5.19	0.84	5.41	652.06	35016	98064
2006-07	4.80	0.83	2.03	0.00	44246	70674
2007-08	4.49	0.82	2.13	2265.60	48809	55056
2008-09	4.40	0.82	3.58	470.61	51076	73603
2009-10	4.52	0.82	-1.33	11347.00	59639	41973
2010-11	4.55	0.82	-0.92	109.93	68331	53714
2011-12	5.59	0.84	3.36	899.68	76255	129289

Source: Annual Reports of the Company**.**

The correlation among the above variables is shown in the table no 1.2 as given below. Each of the variables has been correlated with the other variable to ascertain the relationship among them.

Table 1.2

Correlation matrix of select financial parameters of GRSE

	DE	FL	OL	GICR	NW	Sales
DE	1	0.99	-0.08	-0.34	-0.68	-0.38
FL	0.99	1	0.03	-0.36	-0.74	-0.31
OL	-0.08	0.03	1	-0.28	-0.19	0.66
GICR	-0.34	-0.36	-0.28	1	0.31	-0.22
NW	-0.68	-0.74	-0.19	0.31	1	0.40
Sales	-0.38	-0.31	0.66	-0.22	0.40	1

Source: Correlation based on calculated ratios.

To ascertain the impact , the debt equity ratio has been considered as dependent variable and the others like financial leverage(FL), operating leverage(OR) , Gross interest coverage ratio(GICR), Net worth(NW) and Sales as independent variable. The regression analysis of the above determinants has been shown in the following table no 4.18.

Table 1.3

Regression analysis of capital structure determinants of GRSE

Multiple R	1.00					
R Square	0.99					
Adjusted R Square	0.99					
Standard Error	0.21					
Observations	10.00					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	5.00	28.35	5.67	131.41	0.00	
Residual	4.00	0.17	0.04			
Total	9.00	28.52				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-43.42	3.07	-14.15	0.00	-51.94	-34.90
FL	57.85	3.35	17.27	0.00	48.55	67.15
OL	-0.01	0.03	-0.48	0.66	-0.09	0.07
GICR	0.00	0.00	-0.59	0.59	0.00	0.00
NW	0.00	0.00	1.63	0.18	0.00	0.00
sales	0.00	0.00	-1.07	0.34	0.00	0.00

Source: Regression based on SPSS Statistics

Based on the above ratios, Correlation and regression analysis, the determinants of Capital structure in GRSE are given below. The regression equation shows Capital structure = (-) 43.42+57.85(FL)+(-)0.01(OL) +0.00(GICR) + 0.00 (NW) + 0.00(Sales). The overall result indicates the model is significant. However a detailed analysis is given as follows.

(i) Financial Leverage (FL): An analysis of the data reveals that financial leverage lies in the range between 0.82 to 0.90 in GRSE The correlation analysis shows that there is positive relationship (0.99) of the financial leverage with D/E ratio. The P value as per the regression analysis is 0.00 which is below 0.05(5 percent level of significance) the regression result indicates that the impact of financial leverage on Capital structure is significant.

(ii) Operating Leverage (OL): An analysis of the data reveals that operating leverage lies in the range between -4.37 to 12.35 in GRSE. The correlation analysis shows that there is negative association (-0.08) of the Operating leverage with D/E ratio. The P value as per the regression analysis is 0.66 which is above 0.05(5 percent level of significance)The regression result indicates that the impact of operating leverage on Capital structure is not significant.

(iii) Gross Interest Coverage Ratio (GICR): Ann analysis of the data reveals that GICR lies in the range between 0.00 to 11347.00 percent in GRSE. The correlation analysis shows that there is negative relationship (-0.34) of the GICR with D/E ratio. The P value as per the regression analysis is 0.59 which is above 0.05(5 percent level of significance) The regression result indicates that the impact of GICR on Capital structure is not significant.

(iv) Net Worth: An analysis of the data reveals that the net worth lies in the range between Rs26608 lakhs to Rs 76225 lakhs inGRSE. The correlation analysis shows that   there is negative relationship (-0.68) of the net worth with D/E ratio. The P value as per the regression analysis is 0.18 which is above 0.05(5 percent level of significance).The regression result indicates that the impact of net worth on Capital structure is not significant

(v) Sales: An analysis of the data reveals that Sales lies in the range between Rs 15047lakhs to Rs 129289 lakhs in GRSE. The correlation analysis shows that   there is negative relationship (-0.38) of the sales with D/E ratio. The P value as per the regression analysis is 0.34 which is above 0.05(5 percent level of significance)The regression result indicates that the impact of sales on Capital structure is not significant.

Thus from the above analysis it is noted that except FL, all other determinants are insignificant. However based on significance F (0.00), the overall model is significant at 5percent level of significance.

1.3.6 Determinants of Capital Structure of HAL:

The impact of variables like financial leverage, operating leverage, debt servicing Capacity, profitability and size on the Capital structure decisions of the Company is given below.

Table 1.4
Determinants of capital structure of HAL

Year	DE	FL	OL	GICR	NW	Sales
2002-03	4.46	0.90	2.83	8.62	193081	312042
2003-04	5.00	0.93	3.18	14.77	224142	379979
2004-05	6.30	0.95	2.20	18.67	262856	453380
2005-06	7.23	0.94	1.52	24.46	317108	534150
2006-07	7.68	0.94	0.87	110.39	403442	778192
2007-08	6.61	0.91	1.74	164.46	528372	862312
2008-09	5.72	0.89	1.01	7783.87	661647	1037070
2009-10	4.68	0.86	0.76	89615.33	812352	1145582
2010-11	4.37	0.84	0.33	283953.0	974522	1311408
2011-12	3.87	0.79	2.43	0.00	1133860	1421106

Source: Annual Reports of the Company**.**

The correlation among the above variables is shown in the table no 4.20 as given below. Each of the variables has been correlated with the other variable to ascertain the relationship among them.

Table 1.5

Correlation matrix of select financial parameters of HAL

	DE	FL	OL	GICR	NW	Sales
DE	1	0.77	-0.23	-0.40	-0.53	-0.39
FL	0.77	1	0.18	-0.43	-0.92	-0.85
OL	-0.23	0.18	1	-0.61	-0.47	-0.59
GICR	-0.40	-0.43	-0.61	1	0.53	0.52
NW	-0.53	-0.92	-0.47	0.53	1	0.98
Sales	-0.39	-0.85	-0.59	0.52	0.98	1

Source: Correlation based on calculated ratios.

To ascertain the impact , the debt equity ratio has been considered as dependent variable and the others like financial leverage(FL), operating leverage(OR), Gross interest coverage ratio(GICR), Net worth(NW) and Sales as independent variable. The regression analysis of the above determinants has been shown in the table no 1.6.

Table-1.6

Regression analysis of capital structure determinants of HAL

Multiple R	0.95					
R Square	0.90					
Adjusted R Square	0.78					
Standard Error	0.62					
Observations	10.00					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	5.00	13.94	2.79	7.25	0.04	
Residual	4.00	1.54	0.38			
Total	9.00	15.48				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-26.99	16.86	-1.60	0.18	-73.79	19.81
FL	35.77	17.36	2.06	0.11	-12.44	83.98
OL	-0.55	0.60	-0.91	0.41	-2.23	1.13
GICR	0.00	0.00	-1.64	0.18	0.00	0.00
NW	0.00	0.00	0.41	0.70	0.00	0.00
sales	0.00	0.00	-0.06	0.95	0.00	0.00

Source: Regression based on SPSS Statistics

Based on the above ratios, Correlation and regression analysis, the determinants of Capital structure in HAL are given below. The regression equation shows Cap structure=(-)26.99+35.77(FL)+(-)0.55(OL)+ 0.00(GICR)+ 0.00(NW)+ 0.00(Sales).The overall result indicates the model is significant. However a detailed analysis is given as follows.

 (i) Financial Leverage (FL): An analysis of the data reveals that financial leverage lies in the range between 0.79 to 0.90 in HAL. The correlation analysis shows that   there is positive

relationship (0.77) of the financial leverage with D/E ratio. The P value as per the regression analysis is 0.11 which is above 0.05(5 percent level of significance) The regression result indicates that the impact of financial leverage on Capital structure is not significant.

(ii) Operating Leverage (OL): An analysis of the data reveals that operating leverage lies in the range between 0.33 to 3.18 in HAL .The correlation analysis shows that there is negative association (-0.23) of the Operating leverage with D/E ratio. The P value as per the regression analysis is 0.41 which is above 0.05(5 percent level of significance)The regression result indicates that the impact of operating leverage on Capital structure is not significant.

(iii) Gross Interest Coverage Ratio (GICR): An analysis of the data reveals that GICR lies in the range between 0.00 to 283953.0 in HAL. The correlation analysis shows that there is negative relationship (-0.40) of the GICR with D/E ratio. The P value as per the regression analysis is 0.18 which is above 0.05(5 percent level of significance) The regression result indicates that the impact of GICR on Capital structure is not significant.

(iv) Net Worth: An analysis of the data reveals that the net worth lies in the range between Rs193081 lakhs to Rs 1133860 lakhs in HAL. The correlation analysis shows that there is negative relationship (-0.53) of the net worth with D/E ratio. The P value as per the regression analysis is 0.70 which is above 0.05(5 percent level of significance) The regression result indicates that the impact of net worth on Capital structure is significant

(v) Sales: An analysis of the data reveals that Sales lies in the range between Rs 312042 lakhs to Rs 1421106 lakhs in HAL. The correlation analysis shows that there is negative relationship (-0.39) of the sales with D/E ratio. The P value as per the regression analysis is 0.95 which is above 0.05(5 percent level of significance) The regression result indicates that the impact of sales on Capital structure is not significant.

Thus from the above analysis it is noted that all determinants are insignificant. Based on significance F (0.00), the overall model is significant at 5percent level.

STUDY OF BREAKDOWN CHARACTERISTICS OF DIELECTTRICS

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ABSTRACT :

Modern electrical industry with high voltage levels, needs the investigation of breakdown characteristicsofdielectrics.Aerospaceindustry,suchasaircraftandspacestationapplications, is also requiring much higher power levels nowadays. Switched-mode power supplies offer solution to overcome these challenges. Meanwhile, understandings of the effects of higher voltage levels on insulator breakdown under sub-atmospheric vacuum condition areessential.

Thehighvoltageinsulationbecomesmoreandmoreimportantinpowersystems.Inorderto reduce the losses on transmission lines, higher voltage levels are utilized inmanycountries. Therefore,thedevelopmentofhighvoltageinsulationtechnologiesdeterminesthereliability ofpowersupply.Gaseousdielectrics,especiallytheair,havewiderangeofapplicationsin powersystem.Basicrequirementsforanidealgaseousinsulatoraretobecheap,stable,andnot produceflammableortoxic materialsunderprolongedelectricalstresses.Itshouldalsohave high uniform and non-uniform field dielectrics strengths under AC, DC and pulsedpower.Air,usedasaninsulator,isappliedinmosthigh-voltagetransmissionlinesandopenair circuit-breakers. Under normal circumstances, the air is not conductive andknown asan insulator.Ontheotherhandduetothecosmicrays,itnormallycontainsasmallamountof chargedparticles,butthenumberisextremelylow,unabletoformaconductivepath.However, iftheairgapisappliedacriticalvoltage,thecurrentintheairgapwillsuddenlysurge,with apparentlightandheatphenomenonatthesametime.Thenitwillsuddenlyloseinsulating propertiesandaconductivepathwillbeformed.Thisphenomenoniscalledthegasdischarge.

KEYWORDS: Die-electrics, Transmission, Phenomenon, Gaseous , Electrical

1.0 INTRODUCTION

Modern electrical industry with high voltage levels, needs the investigation of breakdown characteristicsofdielectrics.Aerospaceindustry,suchasaircraftandspacestationapplications, is also requiring much higher power levels nowadays. Switched-mode power supplies offer solution to overcome these challenges. Meanwhile, understandings of the effects of higher voltage levels on insulator breakdown under sub-atmospheric vacuum condition areessential.

Thehighvoltageinsulationbecomesmoreandmoreimportantinpowersystems.Inorderto reduce the losses on transmission lines, higher voltage levels are utilized inmanycountries. Therefore,thedevelopmentofhighvoltageinsulationtechnologiesdeterminesthereliability ofpowersupply.Gaseousdielectrics,especiallytheair,havewiderangeofapplicationsin powersystem.Basicrequirementsforanidealgaseousinsulatoraretobecheap,stable,andnot produceflammableortoxic materialsunderprolongedelectricalstresses.Itshouldalsohave high uniform and non-uniform field dielectrics strengths under AC, DC and pulsedpower.Air,usedasaninsulator,isappliedinmosthigh-voltagetransmissionlinesandopenair circuit-breakers. Under normal circumstances, the air is not conductive andknown asan insulator.Ontheotherhandduetothecosmicrays,itnormallycontainsasmallamountof chargedparticles,butthenumberisextremelylow,unabletoformaconductivepath.However, iftheairgapisappliedacriticalvoltage,thecurrentintheairgapwillsuddenlysurge,with apparentlightandheatphenomenonatthesametime.Thenitwillsuddenlyloseinsulating propertiesandaconductivepathwillbeformed.Thisphenomenoniscalledthegasdischarge.

There are two forms of gas discharge, namely breakdown and flashover. The former refers to the pure air gap discharge, and the latter refers to the gas discharge along a solid surface. Breakdown and flashover are collectively referred as discharge. The gas discharge will only cause a temporary loss of the insulation. Once the discharge is extinguished, it can recover insulation performance, so the gas insulation has a kind of self-recovery insulation property. Air is the cheapest and inexhaustible insulation material. Usually air is used in engineering as the outer insulation of electric equipment and insulation of overhead transmission line, whose breakdownstrengthis30kV/cm.Inthegasdielectric,inadditiontoair,largeamountsofsulfur hexafluoride are used as insulating medium; sulfur hexafluoride gas is often an internal insulation for electrical equipment.

Comparedwithotherdielectricmaterials,vacuumtheoreticallyhasthestrongestdielectric breakdownstrength,becausethereisnoresidualgasandelectroncollisionintheinter   electrode gap.AccordingtoPaschen'sLaw,thesub-atmosphericpressuremeansmuchlowerbreakdown voltagelevelthanatmosphericenvironment.Ontheotherhand,invacuum,breakdownvoltage can be higher than the atmospheric pressures. In practice, there are absorbed gas and other contaminantsexistonthesurfaceofmetallicelectrodesinvacuumenvironment.Generally,the residualgaspressureof10^{-9}-10^{-12}barexistinwhatisconsideredtobethevacuumenvironment, anditiscalled"partialvacuum"environment.Whencertainthresholdelectricfieldintensityis reached, electric field will stimulate charge carriers, and breakdown or flashover will occur finally. However, with a suitable design, the vacuum breakdown strength is still better than most of the dielectric materials. This is why vacuum insulation could be used widely in space

powersystems.It'salsothenecessitywhywestudythebreakdowncharacteristicsofmaterials   under vacuum condition.

With the advanced developments in aerospace technologies, higher power levels are utilizedtosatisfytheincreasingrequirements.TheInternationalSpaceStation(ISS)isusinga 160Voperationvoltagecomparedtoaprevious28Vstandardvoltage,andupto100kWpower level. But more power means heavier power supply system. Generally, researchers use higher frequency level and more compact components to match the requirements. But this, more compact design brings some insulation failures due to the overstress, incompatible coordination.Therefore,switchmodepowersupply(SMPS)becomesmorefavoredbecauseof itsadvantagesincompactnessandeffectiveness.TheworkingfrequencyofhighvoltageSMPS inspacesystemisincreasedfromalowrangeof60Hz~400Hztoradiofrequencyrangeof10 kHz ~ 1 MHz. Thus, SMPS needs a high switching frequency during work. In space systems, high frequency levels enhance the partial discharges and corona, resulting in power loss and degradation, aging or even thermal breakdown of the bulk insulation and components. High frequency also generates electromagnetic interference which disturbs the signal transmissions in space power systems. The dielectric surface composition and the surface charging are affected by the low earth orbit (LEO) plasma and UV irradiation. Also, LEO plasma and UV irradiation generate seed electrons for the breakdown process. The insulation in ground based systems already experience short circuiting, power losses, and impose spurious signals onto communication systems and sensitive sensors due to arcing discharges. In spacesystems, otherenvironmentalfactors,inadditiontotheabovefailures,suchaselectricaldegradationand flashoveratlowervoltagesmightoccurduetothemolecularandparticulatecontaminantsand outgassing.Itisimportanttoclarifythebreakdowncharacteristicswhenthepowersupply working with contaminations under such a high frequency operation.

Significantly, vacuum insulation is a well-known technology for space power systems. But it is significantly important in pulsed power systems and has already been researched for decades. The recent advances of large pulsed power devices enhance the necessity for developing vacuum insulation technologies.

Also, the flashover voltage value of insulation is much lower than that of breakdown voltage in vacuum. This is a significant constraint on development of more powerful and compact pulsed power devices, because the power density transferredthrough high-voltagesystemsislimitedbythesurfaceflashoveracrossinsulators.Thisisthe starting point of continual surface flashover research in high voltage system insulation under vacuum conditions.

Severalunpredictableprocesses,suchaspartialdischarges,coronaandvolumedischarges   are detrimental to power systems and devices as they are the constant source of electro-

magneticinterferenceandenergyloss.Theseprocessescouldresultinbigproblemsas   insulation deterioration and component failure leading to bulk electrical breakdown. Consideringthecomponentsofpowersystem,themostsignificantconditionsarethegeometry ofelectrodegap(homogeneous,inhomogeneous),typeofthefield(polar,andunipolarfields), thetypeofmedium(electronegative,atomic,molecular,etc.),theamplitudeofappliedvoltage, and the operation pressure. The breakdown behavior in vacuum is still not clear completely, even it has been extensively studied for decades. Systemic results about the breakdown characteristics of some different gases are needed when DC voltage is applied [6]. Therefore, thisstudyfocusesonthebreakdowncharacteristicsofgasesunderDCfieldsinpartialvacuum conditions.

The insulating materials influence the breakdown characteristics of total power system. Themostcommonandpopulardielectricsaregases.Thesedielectricsplayanimportantrolein manyspecialhighvoltageareas.Itisvaluabletostudyelectricalpropertiesofgases,especially   under different conditions, such as the ionization, corona and breakdown process.

Inrecentdecades,manyresearchesfocusonimprovingsurfaceinsulationstrengththrough dopingothermetaloxidessuchasaluminaintoepoxy.Therefore,highperformancecomposite insulationmaterialsareproducedtomatchmorerigorousrequirements.Thematerialsmade by adding nano-scale particulates into polymer based bulk are called nano-dielectrics. It has beenobservedthatthesenano-scaleparticulatesbringsignificantimprovementsonthethermal, electrical and mechanical performances of polymeric materials. Besides, initial findings show that the nano-composite materials have lower electrical conductivity and higher electrical breakdown strength compared to the non-filler added polyamides, These properties make nano-dielectric materials prime candidates for electrical insulation for multi-stress and high repetition rate (high frequency operation) for compact and/or high voltage/power electrical systems.

Insulating materials can be used for both insulation purposes and for charge storage, in addition to other purposes like heat conduction (as in liquids) and mechanical support (as in solids),whichmakethemplayasignificantroleinthedesignandperformanceofhighvoltage   power systems.

1.1 Si *pn* junction

A *pn* junction acts as a rectifier since the current through the junction in forward bias is orders of magnitude larger than the reverse bias current. Consider a Si *pn* junction with N_A of 10^{17} cm^{-3} and N_D of 10^{16} cm^{-3}. Since the material is Si the intrinsic carrier concentration (n_i) at room temperature is 10^{10} cm^{-3}. When the *pn* junction is in equilibrium there is a built-in potential, given by

$$V_0 = \frac{K_B T}{e} \ln\left(\frac{N_A N_D}{n_i^2}\right) \dots\dots\dots\dots\dots\text{(i)}$$

For dopant concentrations given above, the value of V_0 is 0.78 V . Now consider the application of a forward bias potential of 0.5 V. This forward bias lowers the barrier between the p and n side and leads to an increased injection of minority carriers forming a current. This excess carrier injection is proportional to the applied forward bias voltage and is given by

$$p_n(0) = p_{p0} \exp\left[\frac{e(V_0 - V_{ext})}{k_B T}\right] \dots\dots\dots\dots\dots\text{(ii)}$$

Here, p_{p0} is the equilibrium concentration of holes in the p side (equal to N_A) and $p_n(0)$ is the excess hole concentration at the interface between the depletion region and n side. For a forward bias of 0.5 V, $p_n(0)$ is equal to $2{:}4 \times 10^{12}$ cm^{-3}. This is more than 8 orders of magnitude higher than the equilibrium hole concentration in the n side (p_{n0}), which is 10^4 cm^{-3}. A similar calculation can be performed for excess electrons injected into the p side, using the equation

$$n_p(0) = n_{n0} \exp\left[\frac{e(V_0 - V_{est})}{k_B T}\right] \dots\dots\dots\dots\text{(iii)}$$

For a forward bias of 0.5 V this is equal to be 2.4×10^{11} cm^{-3}, which is again eight orders of magnitude higher than the equilibrium concentration (10^3 cm^{-3})!

These excess carriers diffuse through the p and n regions and ultimately re-combine with the majority carriers. The diffusion lengths for these minority carriers are determined by their mobilities and the minority carrier lifetimes. The electron and hole mobility values for Si depend on the dopant concentration and are given by 120 cm^{2}V^{-1}s^{-1} and 440 cm$^{2-1}$s^{-1} respectively. The diffusivities can then be calculated from the mobilities using Einstein relation

$$D_e = \frac{k_B T_{\mu_e}}{e} = 3.10\,\text{cm}^2\text{s}^{-1}$$

$$D_h = \frac{k_B T_{\mu h}}{e} = 11.39\,\text{cm}^2\text{s}^{-1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(iv)}$$

The diffusion lengths can then be calculated from the diffusivities and the minority carrier lifetime.

$$L_h = \sqrt{D_h T_h}$$
$$L_e = \sqrt{D_e T_e}$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(v)$$

The minority carrier lifetimes depend on the carrier type and also on the dopant concentration. For this particular pn junction T_h is 417 ns and T_e is 5 ns. So the hole and electron diffusion lengths, calculated using equation (iv), are 21.8 μm and 1.24 μm. A device whose dimensions are longer than the diffusion lengths is a long diode. For this long diode, the diffusion current in forward bias is given by

$$J_D = J_{s0}\left[\exp\left(\frac{eV}{k_B T}\right) - 1\right]$$

$$J_{s0} = e n_i^2\left(\frac{D_h}{L_h N_D} + \frac{D_e}{L_h N_A}\right)$$

Figure 1.1: Reverse bias I-V characteristics of a pn junction. Typical reverse bias current is very low until a certain voltage, when the current increases exponentially. This voltage is called the breakdown voltage and can be a reversible or irreversible process. Adapted from Principles of Electronic Materials - S.O. Kasap.

J_{s0} is the reverse saturation current and is calculated to be $1:23 \times 10^{-11} \text{Acm}^{-2}$. This is the current in reverse bias. For a forward bias of 0.5 V, the current is $3.03 \times 10^{-3} \text{Acm}^{-2}$. This is more than 8 orders of magnitude higher than the reverse bias current, making a *pn* junction a rectifier.

1.2 JUNCTION BREAKDOWN

Consider the I-V characteristics of a *pn* junction in reverse bias, as shown in figure 1. There is initially a small reverse saturation current due to thermally generated electron and holes in the depletion region. This current is called drift current, since this is due to movement of the thermally generated carriers under the applied electric field. With increase in voltage there is a particular value, called the breakdown voltage, beyond which the current increases rapidly. This is called junction breakdown. There are two main mechanisms of junction breakdown, depending on the dopant concentration levels.

Figure 1.2: Avalanche breakdown in a lightly doped *pn* junction. Thermally generated carriers in the depletion region get accelerated by the electric field and cause ionization in other Si atoms producing a cascade of electrons and a rapidly increasing current. Adapted from Principles of Electronic Materials - S.O. Kasap.

1.3 AVALANCHE BREAKDOWN

Avalanche breakdown occurs in moderately and lightly doped *pn* junctions with a wide depletion region. The schematic of the process is shown in figure. Electron hole pairs thermally generated in the depletion region are accelerated by the external reverse bias. Electrons are accelerated towards the n side and holes towards the p side. These electron can interact with other Si atoms and if they have sufficient energy can knock off electrons from these Si atoms. This process is called impact ionization and leads to production of a large number of electrons. This causes the rapid rise in current. The breakdown voltage decreases with increase in dopant

concentration, as shown in figure 3. The large current during breakdown can be modeled by a multiplication factor (M) that relates the current to the breakdown voltage

$$J = MJ_{s0}$$

$$M = \frac{1}{1 - \left(\dfrac{V_r}{V_{br}}\right)^n} \quad \dots\dots\dots\dots\dots\dots\dots(7)$$

where J_{s0} is the reverse saturation current, V_r is the applied voltage and V_{br} is the breakdown voltage. n is a constant of value between 3-5. Closer the

Figure 1.3: Avalanche breakdown voltage as a function of dopant concentration for different semiconductors. With higher dopant concentrations the mechanism changes to a Zener breakdown process. Adapted from Physics of semiconductor devices - S.M. Sze.

Value of V_r to V_{br}, higher is the reverse bias current. This equation is valid only for values of V_r smaller than V_{br}.

1.4 ZENER BREAKDOWN

With increase in doping concentration the breakdown mechanism, changes from Avalanche to a tunneling mechanism. This is called a Zener breakdown. This is because the depletion width decreases with dopant concentration. Also, the reverse bias causes an o set in the bands such that

it is possible for carriers to tunnel across the narrow depletion region. This tunneling process is shown schematically in figure (iv)where electrons tunnel from the valence band on the p side to the conduction band on the n side, driven by the externally applied reverse bias. Tunneling also leads to a large increase in current. The transition from avalanche to Zener as the primary breakdown mechanism with dopant concentration is shown in figure (v). Zener diodes are primarily used as surge protectors in circuits, since there is a rapid increase in current with a small change in voltage. Prior to breakdown there is a high resistance (small reverse saturation current) but after breakdown the resistance is very small. This can be used as voltage regulators in circuits.

Figure 1.4: Tunneling of electrons from p to n side in a heavily doped pn junction under reverse bias. The bias causes band bending such that the valence band on the p side is aligned with the conduction band on the n side. Adapted from Principles of Electronic Materials - S.O. Kasap.

Figure 1.5: Breakdown eld vs. dopant concentration. At lower concentrations the breakdown is due to avalanche mechanism, which shifts to Zenermech-anism at higher values. Adapted from Principles of Electronic Materials - S.O. Kasap.

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STUDY OF BREAKDOWN CHARACTERISTICS OF DIELECTTRICS

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ABSTRACT :

Modern electrical industry with high voltage levels, needs the investigation of breakdown characteristicsofdielectrics.Aerospaceindustry,suchasaircraftandspacestationapplications, is also requiring much higher power levels nowadays. Switched-mode power supplies offer solution to overcome these challenges. Meanwhile, understandings of the effects of higher voltage levels on insulator breakdown under sub-atmospheric vacuum condition areessential.

Thehighvoltageinsulationbecomesmoreandmoreimportantinpowersystems.Inorderto reduce the losses on transmission lines, higher voltage levels are utilized in many countries. Therefore, the development of high voltage insulation technologies determines the reliability of power supply. Gaseous dielectrics,e specially theair, have wide range of applicationsin powersystem. Basic requirementsforanidealgaseousinsulatoraretobecheap,stable,andnot produce flammable or toxic materialsunderprolongedelectricalstresses.Itshouldalsohave high uniform and non-uniform field dielectrics strengths under AC, DC and pulsedpower.Air,usedasaninsulator,isappliedinmosthigh-voltagetransmissionlinesandopenair circuit-breakers. Under normal circumstances, the air is not conductive andknown asan insulator. On the other hand due to the cosmicrays, it normally containsasmallamount of charged particles, but the number is extremely low, unabletoformaconductivepath. However, if theair gap is applied a critical voltage, the current in theair gap will suddenly surge, with with apparent light and heat phenomenon at the same time. Then it will suddenly lose insulating properties and a conductive path will be formed. Thisphenomenon is called the gas discharge.

KEYWORDS: Die-electrics, Transmission, Phenomenon, Gaseous , Electrical

1.0 INTRODUCTION

Modern electrical industry with high voltage levels, needs the investigation of breakdown characteristicsofdielectrics.Aerospaceindustry,suchasaircraftandspacestationapplications, is also requiring much higher power levels nowadays. Switched-mode power supplies offer solution to overcome these challenges. Meanwhile, understandings of the effects of higher voltage levels on insulator breakdown under sub-atmospheric vacuum condition areessential.

The high voltage insulation becomes more and more important in power systems. In order to reduce the losses on transmission lines, higher voltage levels are utilized in many countries.

Therefore, the development of high voltage insulation technologies determines the reliability of power supply. Gaseous dielectrics, especially the air, have wide range of applications in power system. Basic requirements for an ideal gaseous insulator are to be cheap, stable, and not produce flammable or toxic materials under prolonged electrical stresses. It should also have high uniform and non-uniform field dielectrics strengths under AC, DC and pulsed power. Air, used as an insulator, is applied in most high-voltage transmission lines and open air circuit-breakers. Under normal circumstances, the air is not conductive and known as an insulator. On the other hand due to the cosmic rays, it normally contains a small amount of charged particles, but the number is extremely low, unable to form a conductive path. However, if the air gap is applied a critical voltage, the current in the air gap will suddenly surge, with apparent light and heat phenomenon at the same time. Then it will suddenly lose insulating properties and a conductive path will be formed. This phenomenon is called the gas discharge.

There are two forms of gas discharge, namely breakdown and flashover. The former refers to the pure air gap discharge, and the latter refers to the gas discharge along a solid surface. Breakdown and flashover are collectively referred as discharge. The gas discharge will only cause a temporary loss of the insulation. Once the discharge is extinguished, it can recover insulation performance, so the gas insulation has a kind of self-recovery insulation property. Air is the cheapest and inexhaustible insulation material. Usually air is used in engineering as the outer insulation of electric equipment and insulation of overhead transmission line, whose breakdown strength is 30kV/cm. In the gas dielectric, in addition to air, large amounts of sulfur hexafluoride are used as insulating medium; sulfur hexafluoride gas is often an internal insulation for electrical equipment.

Compared with other dielectric materials, vacuum theoretically has the strongest dielectric breakdown strength, because there is no residual gas and electron collision in the inter electrode gap. According to Paschen's Law, the sub-atmospheric pressure means much lower breakdown voltage level than atmospheric environment. On the other hand, in vacuum, breakdown voltage can be higher than the atmospheric pressures. In practice, there are absorbed gas and other contaminants exist on the surface of metallic electrodes in vacuum environment. Generally, the residual gas pressure of 10-9-10-12 bar exist in what is considered to be the vacuum environment, and it is called "partial vacuum" environment. When certain threshold electric field intensity is reached, electric field will stimulate charge carriers, and breakdown or flashover will occur finally. However, with a suitable design, the vacuum breakdown The high voltage insulation becomes more and more important in power systems. In order to reduce the losses on transmission lines, higher voltage levels are utilized in many countries. Therefore, the development of high voltage insulation technologies determines the reliability of power supply. Gaseous dielectrics, especially the air, have wide range of applications in power system. Basic requirements for an ideal gaseous insulator are to be cheap, stable, and not produce flammable or toxic materials under prolonged electrical stresses. It should also have high uniform and non-uniform field dielectrics strengths under AC, DC and pulsed power. Air, used as an insulator, is applied in most high-voltage transmission lines and open air circuit-breakers. Under normal circumstances, the air is not conductive and known as an insulator. On the other hand due to the cosmic rays, it normally

contains a small amount of charged particles, but the number is extremely low, unable to form a conductive path. However, if the air gap is applied a critical voltage, the current in the air gap will suddenly surge, with apparent light and heat phenomenon at the same time. Then it will suddenly lose insulating properties and a conductive path will be formed. This phenomenon is called the gas discharge. There are two forms of gas discharge, namely breakdown and flashover. The former refers to the pure air gap discharge, and the latter refers to the gas discharge along a solid surface. Breakdown and flashover are collectively referred as discharge. The gas discharge will only cause a temporary loss of the insulation. Once the discharge is extinguished, it can recover insulation performance, so the gas insulation has a kind of self-recovery insulation property. Air is the cheapest and inexhaustible insulation material. Usually air is used in engineering as the outer insulation of electric equipment and insulation of overhead transmission line, whose breakdown strength is 30kV/cm.

In the gas dielectric, in addition to air, large amounts of sulfur hexafluoride are used as insulating medium; sulfur hexafluoride gas is often an internal insulation for electrical equipment. Compared with other dielectric materials, vacuum theoretically has the strongest dielectric breakdown strength, because there is no residual gas and electron collision in the inter electrode gap. According to Paschen's Law, the sub-atmospheric pressure means much lower breakdown voltage level than atmospheric environment. On the other hand, in vacuum, breakdown voltage can be higher than the atmospheric pressures. In practice, there are absorbed gas and other contaminants exist on the surface of metallic electrodes in vacuum environment. Generally, the residual gas pressure of 10-9 -10-12 bar exist in what is considered to be the vacuum environment, and it is called "partial vacuum" environment. When certain threshold electric field intensity is reached, electric field will stimulate charge carriers, and breakdown or flashover will occur finally. However, with a suitable design, the vacuum breakdown discharges are detrimental to power systems and devices as they are the constant source of electro-magnetic interference and energy loss. These processes could result in big problems as insulation deterioration and component failure leading to bulk electrical breakdown. Considering the components of power system, the most significant conditions are the geometry of electrode gap (homogeneous, inhomogeneous), type of the field (polar, and unipolar fields), the type of medium (electronegative, atomic, molecular, etc.), the amplitude of applied voltage, and the operation pressure. The breakdown behavior in vacuum is still not clear completely, even it has been extensively studied for decades. Systemic results about the breakdown characteristics of some different gases are needed when DC voltage is applied [6]. Therefore, this study focuses on the breakdown characteristics of gases under DC fields in partial vacuum conditions.

The insulating materials influence the breakdown characteristics of total power system. The most common and popular dielectrics are gases. These dielectrics play an important role in many special high voltage areas. It is valuable to study electrical properties of gases, especially under different conditions, such as the ionization, corona and breakdown process.

In recent decades, many researches focus on improving surface insulation strength through doping other metal oxides such as alumina into epoxy. Therefore, high performance composite insulation materials are produced to match more rigorous requirements. The materials made by

adding nano-scale particulates into polymer based bulk are called nano-dielectrics. It has been observed that these nano-scale particulates bring significant improvements on the thermal, electrical and mechanical performances of polymeric materials. Besides, initial findings show that the nano-composite materials have lower electrical conductivity and higher electrical breakdown strength compared to the non-filler added polyamides, These properties make nano-dielectric materials prime candidates for electrical insulation for multi-stress and high repetition rate (high frequency operation) for compact and/or high voltage/power electrical systems. Insulating materials can be used for both insulation purposes and for charge storage, in addition to other purposes like heat conduction (as in liquids) and mechanical support (as in solids), which make them play a significant role in the design and performance of high voltage power systems.

1.1 Si *pn* junction

A *pn* junction acts as a rectifier since the current through the junction in forward bias is orders of magnitude larger than the reverse bias current. Consider a Si *pn* junction with N_A of 10^{17} cm^{-3} and N_D of 10^{16} cm^{-3}. Since the material is Si the intrinsic carrier concentration (n_i) at room temperature is 10^{10} cm^{-3}. When the *pn* junction is in equilibrium there is a built-in potential, given by

$$V_0 = \frac{K_B T}{e} \ln\left(\frac{N_A N_D}{n_i^2}\right) \quad \text{......................(i)}$$

For dopant concentrations given above, the value of V_0 is 0.78 V . Now consider the application of a forward bias potential of 0.5 V. This forward bias lowers the barrier between the p and n side and leads to an increased injection of minority carriers forming a current. This excess carrier injection is proportional to the applied forward bias voltage and is given by

$$p_n(0) = p_{p0} \exp\left[\frac{e(V_0 - V_{ext})}{k_B T}\right] \quad \text{.....................(ii)}$$

Here, p_{p0} is the equilibrium concentration of holes in the p side (equal to N_A) and $p_n(0)$ is the excess hole concentration at the interface between the depletion region and n side. For a forward bias of 0.5 V, $p_n(0)$ is equal to $2:4 \times 10^{12}$ cm $^{-3}$. This is more than 8 orders of magnitude higher than the equilibrium hole concentration in the n side (p_{n0}), which is 10^4 cm^{-3}. A similar calculation can be performed for excess electrons injected into the p side, using the equation

$$n_p(0) = n_{n0} \exp\left[\frac{e(V_0 - V_{est})}{k_B T}\right] \ldots\ldots\ldots\ldots(iii)$$

For a forward bias of 0.5 V this is equal to be 2.4×10^{11} cm^{-3}, which is again eight orders of magnitude higher than the equilibrium concentration (10^3 cm^{-3})!

These excess carriers diffuse through the p and n regions and ultimately re-combine with the majority carriers. The diffusion lengths for these minority carriers are determined by their mobilities and the minority carrier lifetimes. The electron and hole mobility values for Si depend on the dopant concentration and are given by 120 cm^{2}V^{-1}s^{-1} and 440 cm$^{2-1}$s^{-1} respectively. The diffusivities can then be calculated from the mobilities using Einstein relation

$$D_e = \frac{k_B T_{\mu_e}}{e} = 3.10 \, cm^2 s^{-1}$$

$$D_h = \frac{k_B T_{\mu h}}{e} = 11.39 \, cm^2 s^{-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(iv)$$

The diffusion lengths can then be calculated from the diffusivities and the minority carrier lifetime.

$$L_h = \sqrt{D_{hTh}}$$
$$L_e = \sqrt{D_{eTe}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.\ldots\ldots\ldots\ldots\ldots\ldots(v)$$

The minority carrier lifetimes depend on the carrier type and also on the dopant concentration. For this particular pn junction $_{Th}$ is 417 ns and Te is 5 ns. So the hole and electron diffusion lengths, calculated using equation (iv), are 21.8 µm and 1.24 µm. A device whose dimensions are longer than the diffusion lengths is a long diode. For this long diode, the diffusion current in forward bias is given by

$$J_D = J_{s0}\left[\exp\left(\frac{eV}{k_B T}\right) - 1\right]$$

$$J_{s0} = en_i^2\left(\frac{D_h}{L_h N_D} + \frac{D_e}{L_h N_A}\right)$$

Figure 1.1: Reverse bias I-V characteristics of a pn junction. Typical reverse bias current is very low until a certain voltage, when the current increases exponentially. This voltage is called the breakdown voltage and can be a reversible or irreversible process. Adapted from Principles of Electronic Materials - S.O. Kasap.

J_{s0} is the reverse saturation current and is calculated to be $1:23 \times 10^{-11} \mathrm{Acm}^{-2}$. This is the current in reverse bias. For a forward bias of 0.5 V, the current is $3.03 \times 10^{-3} \mathrm{Acm}^{-2}$. This is more than 8 orders of magnitude higher than the reverse bias current, making a *pn* junction a rectifier.

1.2 JUNCTION BREAKDOWN

Consider the I-V characteristics of a *pn* junction in reverse bias, as shown in figure 1. There is initially a small reverse saturation current due to thermally generated electron and holes in the depletion region. This current is called drift current, since this is due to movement of the thermally generated carriers under the applied electric field. With increase in voltage there is a particular value, called the breakdown voltage, beyond which the current increases rapidly. This is called junction breakdown. There are two main mechanisms of junction breakdown, depending on the dopant concentration levels.

Figure 1.2: Avalanche breakdown in a lightly doped *pn* junction. Thermally generated carriers in the depletion region get accelerated by the electric field and cause ionization in other Si atoms producing a cascade of electrons and a rapidly increasing current. Adapted from Principles of Electronic Materials - S.O. Kasap.

1.3 AVALANCHE BREAKDOWN

Avalanche breakdown occurs in moderately and lightly doped *pn* junctions with a wide depletion region. The schematic of the process is shown in figure. Electron hole pairs thermally generated in the depletion region are accelerated by the external reverse bias. Electrons are accelerated towards the n side and holes towards the p side. These electron can interact with other Si atoms and if they have sufficient energy can knock off electrons from these Si atoms. This process is called impact ionization and leads to production of a large number of electrons. This causes the rapid rise in current. The breakdown voltage decreases with increase in dopant concentration, as shown in figure 3. The large current during breakdown can be modeled by a multiplication factor (M) that relates the current to the breakdown voltage

$$J = MJ_{s0}$$

$$M = \frac{1}{1 - \left(\dfrac{V_r}{V_{br}}\right)^n} \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

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Figure 1.3: Avalanche breakdown voltage as a function of dopant concentration for different semiconductors. With higher dopant concentrations the mechanism changes to a Zener breakdown process. Adapted from Physics of semiconductor devices - S.M. Sze.

Value of V_r to V_{br}, higher is the reverse bias current. This equation is valid only for values of V_r smaller than V_{br}.

1.4 ZENER BREAKDOWN

With increase in doping concentration the breakdown mechanism, changes from Avalanche to a tunneling mechanism. This is called a Zener breakdown. This is because the depletion width decreases with dopant concentration. Also, the reverse bias causes an o set in the bands such that it is possible for carriers to tunnel across the narrow depletion region. This tunneling process is shown schematically in figure (iv)where electrons tunnel from the valence band on the p side to the conduction band on the n side, driven by the externally applied reverse bias. Tunneling also leads to a large increase in current. The transition from avalanche to Zener as the primary breakdown mechanism with dopant concentration is shown in figure (v). Zener diodes are primarily used as surge protectors in circuits, since there is a rapid increase in current with a small change in voltage. Prior to breakdown there is a high resistance (small reverse saturation current) but after breakdown the resistance is very small. This can be used as voltage regulators in circuits.

Figure 1.4: Tunneling of electrons from p to n side in a heavily doped pn junction under reverse bias. The bias causes band bending such that the valence band on the p side is aligned with the conduction band on the n side. Adapted from Principles of Electronic Materials - S.O. Kasap.

Figure 1.5: Breakdown eld vs. dopant concentration. At lower concentrations the breakdown is due to avalanche mechanism, which shifts to Zenermech-anism at higher values. Adapted from Principles of Electronic Materials - S.O. Kasap.

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A STUDY OF THE IMPACT OF GREEN MARKETING PRACTICES ON BUYING BEHAVIOUR AMONG WOMEN CUSTOMER IN KOLKATA REGION

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Abstract:-

Customers are becoming more and more aware of the environmental problems and are actively trying to reduce their impact on the environment by purchasing green products and moving towards a greener lifestyle. This research study tries to determine whether the customer purchasing decisions in Kolkata are influenced by the green marketing practices undertaken by the companies. A sample of 100 women respondents was selected in Kolkata and a questionnaire was used to collect the primary data. Descriptive Statistics (Mean, Standard Deviation and Percentile) and independent t-test. The results of the study highlight that the customer purchasing decisions in Kolkata are not influenced by the green marketing practices undertaken by the companies. However, the customers are willing to pay a premium price for the 'green' products, if these eco-friendly products provide an extra value to them. Thus, companies can command a higher price if they can enhance the product's performance and offer products that provide an extra value to the customers. Integrating appropriate green strategies into their marketing activities in order to achieve a competitive advantage in the saturated markets, there arises a need to understand whether the customer purchasing decision are influenced by the green marketing practices undertaken by the companies.

Keywords: Green marketing, Green Practices, Eco friendly, Green Behaviour

INTRODUCTON

The key challenge for companies and customers today is to preserve and protect the earth's natural environment and finite resources. Production and consumption of goods all over the world has led to the emergence of a large number of environmental problems. As a result, companies are focusing on green marketing and are producing eco-friendly or green products that have less harmful effects on the environment, than the conventional products. Moreover, customers are becoming more and more aware of the environmental problems and are actively trying to reduce their impact on the environment by purchasing green products and moving towards a greener lifestyle. The term 'green' has become the major element driving millions of customers throughout the world, to find out how they live a more environmentally friendly life. Companies nowadays have to integrate appropriate green strategies into their operational activities, product development processes, and marketing activities to achieve a competitive advantage in the saturated markets. Thus, we see that both the marketers and the customers are nowadays focusing on green products and services. Although in the short run, a company may

find it expensive to shift towards the "green" approach, in the long run, it will definitely prove to be advantageous for the company, in terms of cost also.

Green marketing undertaken by companies nowadays refers to the process of selling products and/or services on the basis of their environmental and ecological benefits. Such a product or service may itself be an environmentally friendly product or service, or it may be produced and/or packaged in a manner which is considered to be environmentally friendly. We can assume that customers will view the "greenness" of a product or service's as a benefit and so their buying decisions will be based on this aspect. However, the customers may not be willing to pay more for green products as compared to the less green alternative products. The customers are generally sceptical of the "green" claims of the companies. If the green claims are proved to be false or if the companies make over exaggerated claims, the image and brand name of the companies are at stake. Thus, a case of 'green washing' arises when a company claims its product or service to be green, and then the claim is proved to be false. This will help to change the customers purchasing behaviour in the desired manner. Companies nowadays have to shift to the green approach and have to adopt green marketing activities so as to ensure sustainability of these companies. Although companies are shifting towards green marketing activities, a number of obstacles have to be crossed in order to ensure that the companies achieve competitive advantage in the markets. Firstly, the companies have to invest a lot of money in R&D activities as they have to adopt new technology and integrate appropriate green strategies into their product development processes. Sometimes companies have to use proper water treatment technologies which are quite costly. Secondly, the companies must use renewable and recyclable materials to produce their 'green' products. These materials are usually costly. Thirdly, the customers may not willing to pay a premium price for these products. So the companies must try to offer products with added value to the customers, in order to satisfy them. Lastly, many people may not be aware of such products and their uses. The extensive literature review conducted above highlights that a lot of gap exists on this topic, especially in India. Moreover, not much research study has been conducted in India, as far as the impact of green marketing on customer behaviour is concerned.

LITERATURE REVIEWS

Green Marketing

According to M. J. Polonsky and P. J. Rosenberger (2011), environmental marketing, more popularly known as green marketing or sustainable marketing is an effort by a company to design, promote, price and distribute products in a manner which promotes environmental protection. Green marketing has be defined by them as, "All activities designed to generate and facilitate any exchanges intended to satisfy human needs or wants such that the satisfaction of these needs and wants occurs, with minimal detrimental impact on the natural environment". Green marketing today is a vital component of marketing research due to the pressure on firms to present eco-friendly behaviour and due to the increasing media exposure. Proper adoption of product packaging and presentation of these improvements to the public have promoted the growth of green marketing over the years. Environmental or green marketing practices as a result of compulsion due to legislative pressures and pressures of environmental groups have changed

to genuine efforts to behave in an eco-responsible manner and improve sustainable marketing plans (Polonsky and Rosenberger, 2001).

Green Consumers

Vernekar and Wadhwa (2011) define the green consumer as a person "who adopts environmentally-friendly behaviours, and/or who purchases green products over the standard alternatives". According to Balderjahn (1988), such green consumers are the consumers who have positive attitudes towards the environment and are more willing to purchase green products.

The impact of green branding on consumer buying patterns

According to Pickett *et al.* (1995), if the communications of green branded attributes are not properly undertaken, environmentally sustainable products will tend to be commercially unsuccessful. Similarly, W. Coddington (1993) has suggested that green positioning is an important factor that leads to the success of green branding strategies. However, according to Schlegelmilch*et al.* (1996), the perceived trade-off between functional performance of the brand and its effects on the environment leads to negative consumer responses and reactions. But, Hartmann *et al.*(2005), state that emotional brand benefits are the significant factor motivating consumers to change actual purchase behaviour to buy eco-friendly products.

The impact of green advertising on consumer buying patterns

According to D"souza (2005), advertising terms such as "environmentally friendly, recyclable, biodegradable, and ozone safe" are often seen regularly in green advertisements and consumers are seldom exposed to such messages effectively. However, Chan (2004) has stated that, customers seek more authenticated and concrete product information from these advertisements to guide them in their purchasing decisions. Thus, marketers should publicize environmental information effectively. Moreover, Hawkins *et al.* (1998) stated that emotional content in advertisements is required to increase customers" attention towards these advertisements. Similarly, according to Mendleson (1994), in order to achieve the goal of changing the consumers buying behaviour, marketers and organizations should focus on the ecological knowledge in their organizations as a whole, in their product offerings, and in their advertising campaigns. This will help to change the consumers purchasing behaviour in the desired manner. Companies nowadays have to shift to the "green" approach and have to adopt green marketing activities so as to ensure sustainability of these companies. The extensive literature review conducted above highlights that a lot of gap exists on this topic, especially in India. Moreover, not much research study has been conducted in India, as far as the impact of green marketing on consumer behaviour is concerned. This research paper tries to determine the impact of green marketing on consumer behaviour in Kolkata.

OBJECTIVE OF THE STUDY AND SUMMARY

Customers are becoming more and more aware of the environmental problems and are actively trying to reduce their impact on the environment by purchasing green products and moving towards a greener lifestyle. This research study tries to determine whether the

customer purchasing decisions in Kolkata are influenced by the green marketing practices undertaken by the companies. A sample of 100 women respondents was selected in Kolkata and a questionnaire was used to collect the primary data. Descriptive Statistics (Mean, Standard Deviation and Percentile) and independent t-test.

RESEARCH METHODOLOGY

An exploratory research design and a quantitative research approach have been undertaken in this research study. Secondary data were initially collected from books and the internet, and then a well-structured questionnaire was prepared for collecting the required primary data. There were two sections in the questionnaire which related to the characteristics of the respondents and the impact of the green marketing activities on their buying behaviour. A number of open ended and close ended questions along with a Likert Scale have been incorporated into the questionnaire. A survey was conducted in the different areas in Kolkata, and the sample of respondents included customers in various retail stores in Kolkata such as Big Bazaar, Spencers, Pantaloons, Westside, Shoppers Stop, etc. A convenience sampling method of non-probability sampling has been adopted in this research study and the samples have been drawn from 100 women respondents only, in the various retail stores in Kolkata. A Likert Scale ranging from 1 to 5 has been incorporated in this study, where 1 stands for strongly agree and 5 stands for strongly disagree. Descriptive Statistics (Mean, Standard Deviation and Percentile) and independent t-test with the help of SPSS have been used in this study for analysing the primary data, which is collected with the help of the self-administered questionnaire.And data was collected basically from Kolkata city of which students are 36.6%, job holders are 37.9% and business persons are 25.4% with wide range of income from below 10,000 to above 50,000.

FINDINGS

Green marketing is the new concept being adopted all over the world. In order to preserve and protect the earth's natural environment and finite resources, both the marketers and the customers are nowadays focusing on green products and services. This research findings are as follows:-

- Its highlights that 50% of the total number of respondents agree, or strongly agree that the companies should undertake green marketing activities.
- Itshighlights that the majority of the people i.e.56% are neutral about the companies polluting the environment in which they operate.
- Itshighlights that the majority of the respondents feel that the companies should abide by the environmental laws.
- Itshighlights that the majority buyers are not willing to pay an extra price for the 'green' products offered by the companies.
- Itshighlights that the purchase decisions of 60% of the respondents are not affected by the green marketing activities undertaken by the companies, and the purchase decisions of only 40% of the respondents are affected by the green marketing activities undertaken by the companies.

- Itshighlights that 44% of the consumers prefer to repurchase the "green" products, while 56% are not willing to repurchase such 'green' products.
- Itshighlights that the value of the test is significant, i.e., $p < 0.05$. So, if the null hypothesis were true, there would be a low chance of obtaining the required results. Hence we reject the null hypothesis (H0) and accept the alternative hypothesis (H1). We conclude that the consumer purchasing decisions in Kolkata are not influenced by the green marketing practices undertaken by the companies.

This research study helps to highlight that the customer purchasing decisions in Kolkata are not influenced by the green marketing practices undertaken by the companies. Customers agree to the fact that the companies must undertake green marketing activities, but they are neutral about the companies polluting the environment in which they operate. However, such customers also feel that the companies should abide by the environmental laws set in the country.

Moreover, the majority of the buyers are not willing to pay an extra amount for the green products offered in the market and they are not affected by the green marketing activities undertaken by the companies. Furthermore, the majority of the customers are not willing to repurchase the 'green' products again from the market. In order to achieve competitive advantage in the market, companies must utilise the 4Ps of the green marketing mix appropriately and they must overcome the challenges of integrating appropriate green strategies into their operational activities, product development processes, and marketing activities.

CONCLUSION

Green marketing is still in its infancy in India and more research needs to be undertaken on different aspects of green marketing to explore its potential to the maximum possible extent. When companies adopt green marketing activities, they should ensure that the economic aspect of marketing is not neglected. Thorough understanding of the implications of green marketing activities must be undertaken by the companies so as to ensure that they achieve competitive advantage in the markets.The companies must keep in mind that the customers are very much concerned about the environmental issues cropping up in the country and they are very much willing to pay a premium price for the "green" products, if these eco-friendly products provide an extra value to the customers. Companies can command a higher price if they can enhance the product's performance and offer extra product value by providing better visual appeal, better functions, improved performance, better design, or better taste. Thus, companies must try to locate these opportunities and must take advantage of them.The results of the study highlight that the customer purchasing decisions in Kolkata are not influenced by the green marketing practices undertaken by the companies. However, the customers are willing to pay a premium price for the 'green' products, if these eco-friendly products provide an extra value to them. Thus, companies can command a higher price if they can enhance the product's performance and offer products that provide an extra value to the customers. Integrating appropriate green strategies into their marketing activities in order to achieve a competitive advantage in the saturated markets, there arises a need to understand whether the customer purchasing decision are influenced by the green marketing practices

undertaken by the companies. This research study conducted in Kolkata tries to determine the following:

- ❖ Whether the customer purchasing decisions in Kolkata are influenced by the green marketing practices undertaken by the companies.
- ❖ A proper green marketing mix for the customers as a whole.
- ❖ The challenges faced by companies nowadays while pursuing green marketing activities.

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Tables & Graphs

The following table (Table 1) highlights the number of responses generated towards age, gender and where do the respondents stay.

TABLE 1: Total Responses Generated

		Total Responses
AGE	16-30 years	38
	31-50 years	34
	51 and above	28

Where do you stay?	North Kolkata	19
	South Kolkata	31
	East Kolkata	9
	West Kolkata	15
	Central Kolkata	26

Interpretation: From table 1 we see that the majority of respondents fall in the age group of 16 to 30 years, and aremales. Moreover, the majority of the respondents are from South Kolkata and Central Kolkat.

TABLE 2: Descriptive Statistics

		Undertake the green marketing activities	Concern about pollution	Abide by the laws	Pay an extra price	Purchase Behaviour	Repurchase the „green" product
N	Valid	100	100	100	100	100	100
	Missing	0	0	0	0	0	0
Mean		2.3200	3.2800	2.2600	3.4100	2.9100	2.7800
Std.Dev		1.08901	0.83924	0.9831	0.9816	1.0166	1.4209
Range		4.00	4.00	4.00	4.00	4.00	4.00
Minimum		1.00	1.00	1.00	1.00	1.00	1.00
Maximum		5.00	5.00	5.00	5.00	5.00	5.00

TABLE 3: Undertake the Green Marketing Activities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	21	21.0	21.0	21.0
	2.00	29	29.0	29.0	50.0
	3.00	34	34.0	34.0	84.0
	4.00	11	11.0	11.0	95.0
	5.00	5	5.0	5.0	100.0
	Total	100	100.0	100.0	

Table 3 above highlights that 50% of the total number of respondents agree, or strongly agree that the companies should undertake green marketing activities.

TABLE 4: Concerns about Environmental Pollution

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.00	2	2.0	2.0	2.0
2.00	11	11.0	11.0	13.0
3.00	56	56.0	56.0	69.0
4.00	22	22.0	22.0	91.0
5.00	9	9.0	9.0	100.0
Total	100	100.0	100.0	

Table 4 above shows us that the majority of the people i.e.56% are neutral about the companies polluting the environment in which they operate.

TABLE 5: Abide by the Laws

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	24	24.0	24.0	24.0
	2.00	28	28.0	28.0	52.0
	3.00	41	41.0	41.0	93.0
	4.00	6	6.0	6.0	99.0
	5.00	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

Table 5 above highlights that the majority of the respondents feel that the companies should abide by the environmental laws.

TABLE 6: Pay an Extra Price

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	6	6.0	6.0	6.0
	2.00	20	20.0	20.0	26.0
	3.00	31	31.0	31.0	57.0
	4.00	30	30.0	30.0	87.0
	5.00	13	13.0	13.0	100.0
	Total		100.0	100.0	

Table 6 above shows that the majority buyers are not willing to pay an extra price for the "green"products offered by the companies.

TABLE 7: Purchase Behaviour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	21	21.0	21.0	21.0
	2.00	19	19.0	19.0	40.0
	3.00	32	32.0	32.0	72.0
	4.00	15	15.0	15.0	87.0
	5.00	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

Table 7 above highlights that the purchase decisions of 60% of the respondents are not affected by the green marketing activities undertaken by the companies, and the purchase decisions of only 40% of the respondents are affected by the green marketing activities undertaken by the companies.

TABLE 8: Repurchase the 'Green' Product

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	21	21.0	21.0	21.0
	2.00	23	23.0	23.0	44.0
	3.00	25	25.0	25.0	69.0
	4.00	20	20.0	20.0	89.0
	5.00	11	11.0	11.0	100.0
	Total		100.0	100.0	

Table 8 above highlights that 44% of the consumers prefer to repurchase the "green"products, while 56% are not willing to repurchase such "green"products.

TABLE 9: T Test (One- Sample Statistics)

	N	Mean	Standard Deviation	Std. Error Mean
Purchase Behaviour	100	2.91	1.0166	0.10166
Pay an extra price	100	3.41	0.9816	0.09816

TABLE 10: One- Sample Statistics (Test Value = 0)

	t	df	Sig.(2 tailed)	Mean Difference		95% Confidence Interval of the difference	
	Lower	Upper	Lower	Upper	Lower	Upper	
Purchase Behaviour	14.684	99	0.00	2.91	2.70659		3.11329
Extra Price	22.864	99	0.00	3.41	3.21362	3.60628	

Table 10 above highlights that the value of the test is significant, i.e., p<0.05. So, if the null hypothesis were true, there would be a low chance of obtaining the required results. Hence we reject the null hypothesis (H0) and accept the alternative hypothesis (H1). We conclude that the consumer purchasing decisions in Kolkata are not influenced by the green marketing practices undertaken by the companies.

IMPACT OF INTERNET ON POLITICAL COMMUNICATION IN CITIZENS' POLITICAL PARTICIPATION WITH SPECIAL REFERENCE TO GENERAL ELECTION 2019: A PERSPECTIVE FROM WEST BENGAL, INDIA

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Abstract:

Political communication refers to an exchange of information and ideas regarding politics. It is a domain where various views and ideas of three categories of actors, who have the authority of speaking about politics publicly. Political participation can be explained as having democratic values and standards, having political beliefs and attitudes or displays actual political performance. Contact to the modern form of media raises general interest in campaigns and voting intention. Unlike the electorate's attendance, political interest is used often as a powerful predictor of several primary forms of political behaviour, as political awareness of people is regarded to be highly constant over time. The user base of the internet in world has increased from year-to-year, strength-to-strength and recently driven by mobile has changed several things for the average citizens. Different social media platforms, blogs, online news portals etc. are the main source of political communications on internet. This study shows how political communication on internet influencing citizens' political participation with special reference to Indian general election 2019 from West Bengal perspective.

Keywords: political communications on internet, political participation, internet marketing, internet

1. Introduction

The United States witnessed a huge decrease in voter participation between years 1960 and 1996. According to statistics, it declined from 62.8 percent to below 50 percent. The past 30 years have seen a straight decline of around 42 percent in the number of people who work for a political campaign, around 39 percent in the number of people who serve on a committee for any local organization. In 2004 Trippi observed, the number of people attending public meetings and political rallies has decreased by 35 and 34 percent, respectively. But, citizens' awareness of the process of government and their interest in politics play an extremely vital part in a democratic state. So, it is important to study methods of subverting this existing trend.

Looking at the way the Internet has influenced the recent election process, it can be said that the Internet is becoming increasingly vital to making political choice and establishing a government. The statistics revealed that in 2004, at least 75 million Americans who constitute 37 percent of

the adult population of the country obtained political news and information from the Internet. They not only acquired information about political meetings and rallies but also discussed their preference for candidates and contemporary issues on different forums. Some more enthusiastic lot gathered opinions, filled up survey and participated directly in the political process. The number of viewers of online political news increased from 18 percent of the U.S. population in 2000 to 29 percent in 2004. The very next year Rainie observed, the number of registered voters increased by 50 percent. And this lot is most certainly the one who regarded the Internet as one of their primary sources of information about the presidential election throughout.

According to Davis' observation, during the American pre-elections in 2007, every presidential candidate won 500 social network participants daily, to spread their political message further. From that point forward, the use of Internet for political purposes has increased massively. Political groups these days employ Internet specialists to campaign for them in order to explore the opportunities the Internet has offered (Suellentrop, 2000).

McCombs and Shaw observed that the Internet is the strongest form of worldwide communications. It is not only a source of news and information to voters, but also a decision maker in many contemporary political issues and plans of an election. The internet brought political reporting within extensive public contact and thus allowed individuals more clarity and better understanding about political issues and contestants. We can say when print media experienced very thin readership for political information and audio-visuals like radio and TV had somehow managed to retain public interest with varied audience, the Internet was trusted by more individuals as a source of information about the political situation of the country. This unprecedented phenomenon raised a significant question:

"Can the development of the Internet as an information source raise interest in politics and stimulate participation in the political process?" (Weaver, 1996; Tolbert and McNeal, 2001; Bimber, 1999).

2. Theoretical Background of the Study

A major Study conducted by Polat in 2005 has shown that a wide and transparent communication system and data-availability can maximize citizens' ability and inspires them to take part in the political process. By function, the Internet is just another form of communication technology created by fusing audio-visuals aspects of print media and television with the speed of telephone. It encourages more access to current affairs as well as provides a simple way to enter political organizations. Interactive tools like message boards and chat rooms permit Internet users to create virtual networks so as to talk about political candidates and issues. Since this innovation is so new, there are ongoing researches to find out its real effect on the political procedure.

Mobilization and Reinforcement are two opposing theories that attempt to clarify the impact of the Internet on political participation. In the year 1999, Pippa Norris successfully summed up these two hypotheses. Mobilization theories state that the Internet as mass media has brought in a new form of public engagement that empowers citizens and multiplies their social capital

through its attempt to reduce the gap between people and the government. Therefore, this novel communication technology can be used as a tool of democracy. Mobilization theory looks at a possibility of vast expansion of the Internet. As a result, as Norris (2002) predicts, it will outperform both television and print media as the primary and most trusted source of news and information for both general and election related news.

In sharp contrast to this theory, the grounds of Reinforcement theories was that extensive use of Internet will not profoundly change the existing form of political communications, as claimed by Mobilization theorists. Referring to the digital divide, the supporters of this theory say, society will be split into two sections on the basis of one's access to the Internet. The Internet will just serve to perpetuate this divide and widen the gap between the haves and the have-nots. They further explained that very few refined voters understand rightful candidature and state policies, which are essential in running the government. Only those individuals with early association with or psychological keenness for politics will be motivated to engage in legislative matters. So, Internet with all its power can infuse spirit and enthusiasm in a handful of interested people, so the ambition of politically empowering citizens may not at all serve its noble purpose and relegated to only a myth.

3. Discussion on Political Communication

3.1. Conventional Political Communication

Political communication refers to an exchange of information and ideas regarding politics. It is a domain where various views and ideas of three categories of actors, who have the authority of speaking about politics publicly. These actors include politicians, public opinion and journalists. The voice of these people, mainly the views of the public are highlighted through news, commentaries, and reports and so forth that affects politics invariably. The position of media in traditional political communication is significant as they influence agenda-setting. The conventional form of political communication mainly includes newspaper, television, radio, posters, electoral campaign, short commentary, interview, wall writing and announcements. Traditional media is considered more user-friendly in terms of posting on a follower page. The aim is to reach the maximum possible recipients (Giemza, 2014). The pamphlet such as newspapers are rooted in the 17th century, however, was still a cessation from more traditional ways of expressing or determining public opinion. In American societies, during the 18th century, without school tests or written compositions on government, people obtained knowledge about politics by taking part in a respectful and secondary role in rites of authority. People used to get an idea about the government by appearing in public executions or courthouse sessions. Voting was an act of dominating communication as of solicitor communication. For example, in Virginia, it was usually an act of compliance, as no secret election was there. The sheriff used to ask the executor about their favourite candidates in their presence. Then the privileged candidate used to thank the constituent. Politics was a distinct domain of acts as it was only one extra countenance of the protocol of a civil society in which discrimination was taken for granted. However, the political culture of New England allowed more chance for a petitionary political look. In the colonies, political writings were focused on the government and not to the populace

until the 1720s. By 1750s, the newspapers and pamphlets were focused on voters and printed in many thousand copies (Shodhganga, 2019a).

3.2. Discussion on India

Beside the other modes which are popular throughout the world, different other methods were also used for political campaigns.

In terms of political communication in India, it has been done applying different type of media as well as non-media techniques. One of the most primitive types of political communication was town crier. Further, there has always been a civil society in the firm of Chaupal. It was a place for conducting political communication and making important decisions. The elders of the village took the decisions. Later, it was turned into Panchayat. After independence, Bhajan Lal and Choudhari Charan Singh have been famous for using the Chaupal to gather political distance. Even the meetings of Mahatma Gandhi used to be arranged in an environment like Chaupals. Besides, folk media such as Tamasha, Keertan and puppet shows were also some public medium of carrying out political communication. The purpose of Keertan was spreading socio-political messages. Thus, the system of political communication in India was widespread much before the presence of media. However, after the advent of press and media, political communication became much more comfortable. The newspaper had an essential contribution toward the freedom battle of India. Next, appeared television and radio as the communication medium of politics. However, because of scarcity at the time of freedom fight, the TV could not be mainly used. Although, TV, newspaper and radio did not offer a straight attitude or interaction mode with the people for the political parties and candidates. Therefore, the political parties and politicians used other types of political communication, such as bicycle and motorcycle rallies. There were tempos, vans and cars too with a respective political candidate or their demonstrative on one of the transportations. Thus, the politicians used to create direct communication with the voters. Maximum communication related to politics takes place in India at the time of elections. Therefore, the electoral campaign was considered as the most potent way of political communication in India. Hence, public interaction and door-to-door campaigning by public meetings were usual at the time of elections. Media utilisation by politicians for interacting with the voters was also an essential part of political communication (Lama, 2014).

3.3. Discussion on West Bengal

Among all the states of India, West Bengal is the only state that was ruled by a single political party for more than three decades without any interruption. The stability in the political condition is hard to clarify based on the financial state only. A well minion democracy involves political awareness and participation of underprivileged and needy in politics. The level of political participation in votes, political campaigns, political knowledge, contact to media, village meetings and program awareness directed by the GPs (Gram Panchayat) used to be high in WB. However, besides education, immigration status, social backwardness and gender were a significant influencer of political participation in the old time in WB. Moreover, regulatory for economic and demographic characteristics, villages with a high proportion of schedule tribe and scheduled caste communities represented a notably higher level of political participation. In India, the National Election Survey practices household studies for assessing political

involvement, preference and attitude. However, with minimal exemptions, political conduct is not linked to socio-economic features of the household in general. The survey emphasises on the national level, voting instead of the local governance system. Overall, the participation political activities such as involving in political meetings and rallies and political campaigns, providing financial support to the political parties were high in WB. The study found that ear about 69%households made a financial contribution to the political parties, a section rising consistently with landholding. Further, 26% of the household engaged in political campaigns (Bardhana*et al.* 2008). As stated by Roy (2017), traditionally, the participation of women in politics was significantly low. It was smaller than the number of women in the parliament accounts to 13.26% in WB. The depiction of women within the Legislative Assembly of WB revealed that only six women chosen among 238 seats in 1952 and 2016, the number of female MLAs increased to 39 among 294 places. Although the proportion of women participation in WB politics fluctuated always, it never goes beyond the edge of 14%. It shows that women participation in politics is traditionally lower in WB.

4. Penetration of Internet Users

4.1. History of internet

As one might believe for technology so costly and ever transforming, it is hard to acknowledge a single individual for the origination of the web. The internet is the efforts of dozens of revolutionary scientist, engineers, programmers, each of whom developed new technologies and structures that ultimately combined to become the worldwide computer network, known today. Long ago, the technology existed to create the internet. Several scientists have forecasted already the presence of global information networks. In the 1900s, Bikola Tesla with the notion of a world wireless structure and impracticable philosophers such as Vannevar Bush and Paul Otlet considered of the searchable, automatic storage system of media and books in 1930-40s. The first real-world diagrams for the internet would not work out till 1960 when MIT's J.C.R. Licklider promoted the notion of an interstellar network of computers. After that, a process for transferring electronic data that would become one of the principal components of the internet later. In the late 1960s, the first practical example of the internet arrives with the formation of ARPANET (Advanced Research Projects Agency Network). The U.S Department of Defence funded the ARPANET, which used packet swapping for enabling several computers to connect on a single network. The technology developed continuously in 1970 until Vinton Cerf and Robert Kahn developed the Internet Protocol and Transmission Control Protocol. It was a communication prototype, which sets criteria for the way data could be transferred within several networks. ARPANET espoused the TCP/IP in 1983, and since then, the researchers started to accumulate the network of networks, which took the form of the modern internet. In 1990, the online world became more recognisable when Tim Berners-Lee, a computer scientist, conceived the WWW (World Wide Web). The web is the most general process of accessing data online as hyperlinks and websites. It helped to make the internet famous among people and acted as an essential phase in evolving the massive trove of data, which most of the people access daily at present (Andrews, 2019).

4.2. Discussion on India

In 1995 15th August, internet history of India began with VSNL introduces the service, and in six months they managed to obtain 10000 users. In India, the usage of data increased. Most of the users preferred mobile internet. The study showed that 80% people used the internet for online communication, 74% used for social media, 30% used for entertainment, 13% for shopping and 11%for ticketing (Rajkumar, Sharmila& Rebel, 2016).

The user base of the internet in India has increased from year-to-year, strength-to-strength and recently driven by mobile has changed several things for the average Indian. Over the past decade, the inclination for communication, information exchange, financial transaction, shopping and search have changed drastically in India. This change has been fuelled by use belongings afforded by internet technologies and more prominently because of adoption and penetration of mobile internet. Even if the internet and mainly mobile internet rise are receiving new heights every year, internet penetration in the country has lingered comparatively uninspiring until now. Even with relatively lower infiltration of the internet, India has the third largest base of internet users around the world. It is projected to become the second biggest user base. While comparing with major developed markets or other similar emerging markets like China and Brazil, India has still a long way to cover with a large share of the people even without internet access. As of 2014, internet penetration in India is 19.2%. In India, internet penetration grew to 19.19% in 2014 from 13.7% in 2013. The rise in internet saturation is because of the increasing number of internet connections and users. The total user base as of October 2014 was 278 million and 503 million in 2017. India includes 174 million interconnections united between wire line and wireless connections by the end of 2013 (KPMG-IAMAI, 2017).
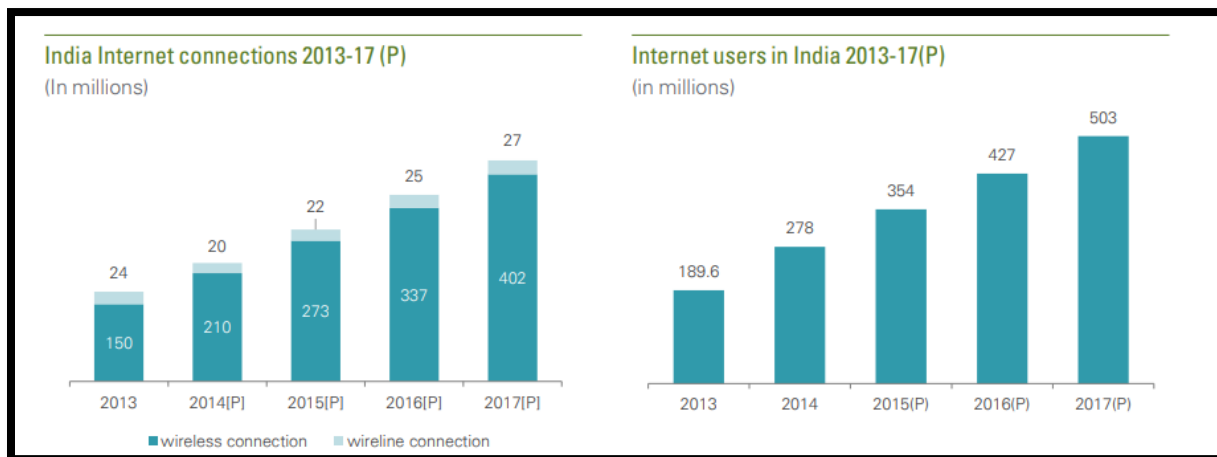

Figure 1: Internet connection and internet users in India in 2013-2017

(Source: KPMG-IAMAI, 2017)

In 2019, the number of internet users is expected to reach to 627 million in India. It is due to the rapid growth of internet use in rural areas. Internet use has crossed half a billion for the first time,

fastened at 566 million. The annual growth rate of internet penetration is 18%/year (Economic times, 2019).

4.3. Discussion on West Bengal

Over 50% of the new users of the internet in India will belong to the rural communities that will comprise near about 48% of linked internet users by 2020. 'The Rising Connected Consumer in Rural India' report reveals this information, and it also discloses that the number of users in the rural area will rise approximately 120 million to 315 million within 2015-2020, recording near to a 30% y-o-y progression. Cheaper handsets, the outburst of wire line and wireless networks will influence the growth. However, it will transform the way rural customers contact with organisations, as the report asserts that the internet usage pattern is different in rural areas from that of urban areas. The internet use is penetrated among men, mostly which accounts for 98% of all rural users. In urban areas, 79% of users are male. However, the number of female users is increasing rapidly (Manna, 2014).

5. Discussion on Political Participation

5.1. Traditional political participation

Political participation can be explained as having democratic values and standards, having political beliefs and attitudes or displays actual political performance. Contact to the modern form of media raises general interest in campaigns and voting intention. Unlike the electorate's attendance, political interest is used often as a powerful predictor of several primary forms of political behaviour, as political awareness of people is regarded to be highly constant over time. Thus, it seems like political attention decides whether the population would be politically dynamic or not. Participating in politics increases the political interest of citizens. Responsiveness to political news is highly linked to political importance, and the connection is both reciprocal and casual (Kruikemeier *et al*. 2014). **Traditional political participation** is a variety of acts that influence the government in terms of voting and other areas, including volunteering or protesting camping. For example, in the U.S, people are allowed to present their input to their preferred candidates by voting to run the country. Such activities are regarded as important and without them; the country would not have able to acquire its current position. Different factors, such as race, influence political participation. It is stated that Asians have more than aggregated resources, and they are entrenched sturdily in their residential societies. Political participation in the old times is also affected by community rule of eluding political engagement, the attitude that voting politics is a time-waste, experience of refinement and absence of political governance. Latinos and Asians are identified as having the lowest political participation for several reasons, and immigration is one of them (Shodhganga, 2019b).

The protest was the traditional way of people would take part in political communication, when the election was permissible for white males only. Until 1900, only white males of more than 21years age were allowed to suffrage. They were mostly landowners. When the establishment opened up the election to everyone, the states levied taxes advertisement knowledge tests, which has to be fulfilled for voting. During 1950, a non-violent protest started to support for equal rights (Borooah & Tagat, 2017).

5.2. Discussion on World

According to Ghatak (2010), political participation has a high significance in any political system. The traditional theory of democracy considers individuals' involvement in political activity as an asset in their rights. It is a civic duty of all population to involve in politics, and it is a determinant of political health. The accomplishment of a democratic political system relies on the nature and level of political participation within the citizen of the nation regardless of colour, caste, religion and sex.

Participation in the voting process includes much more than voting only. Political participation originates from the freedom of speech, associate and assembles the ability to participate in the conduction of public dealings and the chance of being registered as a candidate to become voted, to campaign and to have an office at all government levels. Under global standards, women and men have the same rights to involve in all political aspects. However, practically, it is often difficult for women applying the right. Within the post-battle countries, additional barriers were there for women to engage in politics and special care is needed for ensuring their rights are esteemed in this concern. The highest common way to chosen office is by political parties. Maximum candidates rely on parts in terms of their nomination, voter support base, helloing in their campaign, continued support after votes and providing financial resources. While some of the candidates operate office independently, it is highly challenging to win an election without the assistance of a political institution, manly at the national level (United Nations, 2019).

Politics has remained a male domain traditionally. Therefore, several women have found this domain as hostile and unwelcoming. In societies, where traditional values remain resilient may glare on women joining politics. Moreover, to deal with adverse cultural forecasts, women were more likely to face hands-on barriers comparing to men when entering politics including lower education level, scarcity of monetary resources, higher family responsibility, lower information access and a lack of rights that reduced opportunities for them to gain political experience. They also lacked the necessary political connections for voting success. Barriers to political participation of women are overstated often in post-conflict communities that can be featured by belligerence, an unstable safety situation and the political supremacy of a small group. Moreover, lack of well-built political parties, not including women in the negotiation regarding peace and the institutions created or implementing order accompanied by other limiting forces acted a barrier toward political participation of women. It became even more challenging for a woman becoming a political leader. However, countries after conflict used to provide some unique chances to implement changes in the political culture and structure, which ensures the identification and realisation of rights of women to take part equally and entirely in politics. United Nations and other global performers can make a vital contribution to the efforts in post-conflict nations (United Nations, 2019).

5.3. Discussion on India

As stated by Magallares & Talò (2016), political participation contains actions like joining a non-governmental activism group or a political party, running as a voter candidate and campaigning. It is often measured by asking candidates whether they voted in national elections or last election or by asking them to analyse using a single item, their level of engagement in

community activities. Political participation is drenched by four first-order underlying variables including civic attendance, disengagement, activism and formal political participation.

Political participation refers to the engagement at different stages in the political system. Involvement itself articulates in various types of explicit or apparent legislative acts. In general, **Indian** women, especially women of WB, stands away from the political domain comparing to their male foil (Ghatak, 2010). As stated by Borooah and Tagat (2017), polling in elections is only a side of political participation. Another form of assistance can be participating in and attending political meetings. It is specifically pertinent to the Indian village from the time when the constitution act 1993 was imposed. The law made it obligatory for all the villagers having a village assembly containing all the registered electorates on the voter move of a village. The Gram Sabha developed and assigned with the authority of overseeing the operation of the voted village Panchayat and for appreciating the development plan of the Panchayat for the town and the linked budget. Therefore, besides voting, voters in the community had another type of political engagements; they could join the meeting of Gram Sabha and take part in its discussion too.

The Indian constituents approved the right to elect as a general technique to all the mature people by the standard of equality that is one of the highly used types of traditional political participation. The eccentric processes of political participation need to be scrutinized for ensuring that any protests and distresses do not get in a dangerous form of dispute act, as it is regarded as additional legitimate ways of participation. This, it suggests that involvement in politics involves traditional and unconventional political participation process in a restricted democratic structure (Shodhganga, 2019b).

5.4. Discussion on West Bengal

Among all the states of India, West Bengal is the only state that was ruled by a single political party for more than three decades without any interruption. The stability in the political condition is hard to clarify based on the financial state only. A well minion democracy involves political awareness and participation of underprivileged and needy in politics. The level of political participation in votes, political campaigns, political knowledge, contact to media, village meetings and program awareness directed by the GPs (Gram Panchayat) used to be high in WB. However, besides education, immigration status, social backwardness and gender were a significant influencer of political participation in the old time in WB. Moreover, regulatory for economic and demographic characteristics, villages with a high proportion of schedule tribe and scheduled caste communities represented a notably higher level of political participation. In India, the National Election Survey practices household studies for assessing political involvement, preference and attitude. However, with minimal exemptions, political conduct is not linked to socio-economic features of the household in general. The survey emphasises on the national level, voting instead of the local governance system. Overall, the participation political activities such as involving in political meetings and rallies and political campaigns, providing financial support to the political parties were high in WB. The study found that ear about 69%households made a financial contribution to the political parties, a section rising consistently with landholding. Further, 26% of the household engaged in political campaigns (Bardhana *et al.* 2008). As stated by Roy (2017), traditionally, the participation of women in politics was

significantly low. It was smaller than the number of women in the parliament accounts to 13.26% in WB. The depiction of women within the Legislative Assembly of WB revealed that only six women chosen among 238 seats in 1952 and 2016, the number of female MLAs increased to 39 among 294 places. Although the proportion of women participation in WB politics fluctuated always, it never goes beyond the edge of 14%. It shows that women participation in politics is traditionally lower in WB.

6. Discussion on Political Participation of Recent Citizens: The Impact of the Internet on Political Communication

6.1. Political Participation: The Effect of Internet

It can be perceived as accurate that the socio-economic forces are significantly linked to political involvement. However, the use of the internet has influenced people to participate actively in politics by sharing their opinion with a higher number of people through social media. Thus, it promotes democracy, as well. Today, people can create a virtual community. A social combination that cultivates from the internet, when a sufficient number of people conduct discussion elongated enough with adequate human sentiment to develop networks of personal connection in the information superhighway. Thus, the virtual community improves the degree of political participation within its users. Internet having full information and data that motivate people psychologically and enhance their confidence level to the extent that they want to involve in political acts. Besides, intent improves administrative capacities of users by reducing the resource retrains and cost and increasing their intra-organisational expansive skill, which the most valuable skill for acquiring and expanding social capital. It is essential for social equality, as it lays the basis for individuals to the internet and develops trust within each other and create a public network. Apart from that, the one-liners have the opportunity and the platform for airing their voice and opinions to the elected legislators, government and administrators (Meesuwan, 2016). As opined by Kruikemeier (2014), with the initiation of internet, modern online technologies and online platforms have changed the way people participate in politics or political communication. New types of internet organising facilitate hiring previously indolent citizens into political participation. Cyberspace has emerged as a vigorous medium for political debate. It means the internet does not encourage new people to be engaged politically; instead, it involves people who are already involved. This occurrence is often called reinforcement.
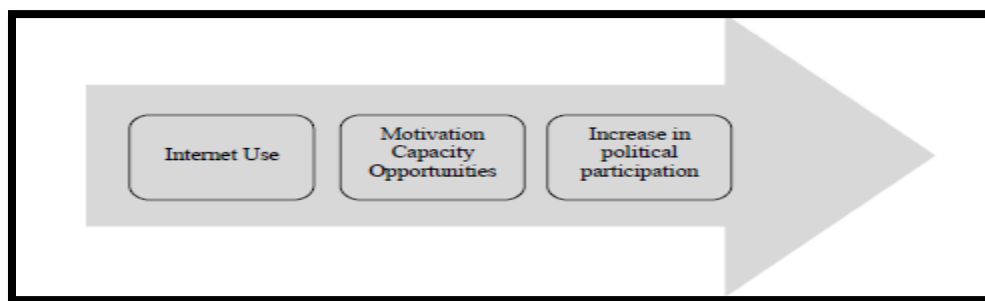

Figure 2: The way the internet increases political participation of people

(Source: Meesuwan, 2016)

6.2. Discussion on world

Since the intensification of the internet, its potential role in improving the quality of democracy by increasing participation of citizens in politics is claimed. Internet use in politics has fostered extremely. During the last decade, political parties and chosen representatives have utilised the internet to notify citizens and members of political parties about their viewpoints, plans and everyday business. Today, online communication is regarded as a crucial component of a successful voting campaign. The internet provides an easy right to have political information, offering all types of a chance for people to take part in political discussions and for politicians to talk interactively with electorates. However, the real number of people, who discusses politics using the internet is still limited, and this group mostly contain that populace, who are interested or predisposed in politics already (Kruikemeier *et al.* 2014). However, Larson (2004) stated that an improved communication system for the rise of the internet and increased availability of information influence the desire and ability of citizens taking part in the political process. Internet is a modern communication technology, which includes the audio-visual feature of TV and newspaper with the speed of cable and telephone delivery systems. It stimulates new people to participate in politics, thereby increasing their political participation and enlistment by inspiring in equal democracy.

Barak Obama election campaign in 2008 is an ideal example of this. 46% of all the Americans took the help of the internet for obtaining news on the campaign, sharing their opinions and mobilising others. The election campaign in 2008 glowed the unprecedented awareness and concern within voters. The survey found that $1/3^{rd}$ Americans had been watching the news on the primary campaign diligently. Such interest level had not seen generally until the last election period. In this context, a huge number of people not only went online to known about Obama's campaign but also played an active part in encouraging online debates on politics and disseminating information and news about their preferred candidate. At that time, 19% of American people used the internet once or more in every week for obtaining or sharing information related to the voting campaign, and 6% used the internet every day for involving politically. Additionally, 23% of people got emails with a request to discuss the campaign or to vote for a candidate. Besides, 10% of Americans used emails for carrying put political discussion with an equal frequency (Smith, 2008).

6.3. Discussion on India

All the Indian politicians consider internet and social media as a mean for reaching to the voters. It has gained significance with the increase in young people in India, as they use internet maximum. It has allowed higher political cognizance and organisation. In this country, everyone has been recognising the new and strong interaction medium with people and influencing them to take part in political communication. Indian politicians irrespective of age have begun experiencing the effect of the internet and social media. Therefore, now, all the political parties use social networking sites for conveying their messages to the population. Today, political campaigns are not limited to banners and buttons for politicians to contact with their constituents. The Internet has created an advance political arena, where politicians use hundreds of blog posts, tweets and commercials. Now Indian politicians using the internet are capable of presenting their message constantly though countless commercials, they can see responses to

their activities directly through Twitter, Facebook, Instagram and connect to people. It has formed a new political discussion. Neyazi, Kumar & Semetko (2016) stated that evidence shows that online participation results in political involvement. All the political parties use digital information network for sharing information on electoral campaigns that is an important predictor of political participation in the voting campaigns.

Here, the example of **the BJP (Bharatiya Janata party) election in 2014** can be considered. Along with the Congress party, BJP was trying to experience the digital wave before the general election in that year. The party used a dozen of tech experts for crunching the data on users of social media. The collected data were categorised based on gender, type of social media users such as Facebook or Twitter and the medium of accessing internet such as a computer, mobile, tablet, and so on. Arvind Gupta, the leader of the IT team and an IIT graduate, said social media could influence the elections in 160 seats in Lok Sabha, where approximately 20% electorates had internet access (Business Today, 2013). In the **election campaign of 2019,** also the impact of the internet is evident, as Facebook noted hundreds of pages. The conventional media of India made the maximum media object possible and transformed it into a BJP versus Congress thing. Facebook is accused of forming such impression by highlighting only the name of Congress initially. Eventually, the position of BJP became clear, with 26 lakh followers on one page. However, social media is also accused of spreading fake news that must be restricted (Venkata ramakrishnan, 2019).

6.4. Discussion on West Bengal

Internet and specifically the social media have a direct impact on the election of WB. The Campaign 360 and the Internet & Mobile Association of India taking the support of Facebook India has published a report on the effect of social media on the elections of WB Assembly. The report shows that 70 High Impact voters in WB the outcome of which is possible to be affected by the users of social media. 21 medium impact and 203 little impact electorates are also there in the state. A report opposes that 1 out of 4 or 24% voters that have been categorised as High Impact can decide the ultimate winner of the WB. Result of a web survey shown that print media and TV are still considered as the most reliable model media for collecting information on elections whereas, 41% people depend on social media, and 21% rely on digital news. The report also found that 2 in 5 users of social media in WB also ponder social media as the most trusted information source for contents related to elections. 90% of internet users follow lection of WB on social media (MXM India, 2016). For example, in the **election campaign of 2016**, the Trinamool Congress and other political parties stretched their battle into the cyberspace cussing by the radical effect of social networking platforms. However, the TMC leader and WB chief minister, Mamata Banerjee topped the chart, as she uses Twitter and Facebook regularly. She has 16 lakh fans on Facebook and 2.6 lakh followers on Twitter. Using the platform, the party shared all its information, concerns and achievement to the people for gaining their support in the election (The Economic Times, 2016). Further, in the **2019 election campaign**, TMC carried out a social media campaign named' Pradhan Mantri Hisab Do', which compares the scheme of Narendra Modi called 'Beti Bachao Beti Padhao' and the scheme of a state government called 'Kanyashree'. It revealed the prime minister's scheme as a failure and thus, tried to influence the voters to support TMC instead of BJP (Das, 2019).

7. Recommendations:

Based on our study we can recommend that election commission of India can use internet more effectively to get better voter turnout in India. In the urban areas voter turnout is very less in different elections because of different factors. Election commission can run extensive awareness program on the internet to increase voter turnout.

This study supporting that political participation is increasing due to political communication on internet. Political parties are using different social media platforms, news portals, video channels to spread their views and trying to create political mass opinion. But fake news/information is destroying the sanity of internet usage for political communication. Nowadays conscious internet users are in doubt to believe any news/information blindly. They are cross-checking information from different sources. It is also misleading common people and creating social hazards. So, it is the responsibility of the political parties and their supporters to stop the spreading of fake news/information. Otherwise the reliability and credibility of political communication on internet will suffer.

8. Implementation of the Study

Through this study a political internet marketing model can be proposed to the different political parties. We can also findout different factors which can better influence the urban voters of West Bengal, India. It can create a better impact on political campaign.

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DIGITALIZATION AND INDIAN DEMOGRAPHY: STUDYING THE ROLE AND READINESS OF CONSUMERS AND GOVERNMENT IN DIGITAL INDIA

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Abstract

Consumer behavior has been a difficult phenomenon for marketers to study. And when Indian consumers are involved it becomes all the more esoteric. India is the second largest country by population and its consumers' behavior complex. Perhaps this is why knowing the behavior of consumers is a daunting task for marketers in India. Given the rapid advancement of technology and a growing urge for digitalization, marketers have become all the more desirous of seeking consumer characteristics and exploring their behavior to build upon their courses of actions and further their marketing interests. With the country desperately wanting to go digital, it becomes pertinent to first analyze the consumer characteristics, their behavior towards digitalization, their attitude and opinions towards it, etc. Moreover it also becomes important and relevant to dig information about how secure and protected consumers feel as far as digital transactions go. The paper focuses upon such aspects of consumer behavior which bring out a detailed understanding only to facilitate marketers in their decision making process and thereby enable them to make prudent marketing choices. The paper also works upon the various facets of digitalization and its allied aspects on which the government needs to work and put in place proper and stringent cyber laws to ensure increased participation of Indian consumers in digitalization.

Keywords: Digitalization; consumer behavior; consumer readiness, government role play

1. Introduction

Today, technology represents a way for developing nations to facilitate economic development, to better the chances of survival and growth in domestic as well as global markets and to seek ameliorated and improved chances of doing business anywhere around. The rapidly growing use of technology has multitudinously enhanced the possibilities for businesses. And India is no exception to it. India with its current set of demographic profile assumes a form of a pretty huge market, which is why it becomes significant to know about it and the countless possibilities and challenges it holds in its ambit.

India finds itself at an extremely unique crossroad- the coming forth of a demographic transition in an era of digitalization. To make the most of this opportunity, India will require a renewed focus and a quantum leap in the field of business. Without an iota of doubt, digital technologies can aid in making the giant leap a possibility. But how prepared India is to make the most of the existing and impending technology is an area that remains to be touched, observed and worked out.

Indian marketers, rural and urban alike have adapted to the changes in technology and so have the consumers. Everybody is going digital pretty fast, snapping up smart phones. E-commerce is galloping at a horse's pace, knowing no bounds. But, is it right? Is it safe and secure? A lot of questions like these surround us and they need to be importantly addressed before unleashing our urge to digitalize. India's urge for digitalization is getting more and more with each passing day. The government at whatever levels possible also looks to be doing its bit by creating digital awareness and a more digitized

environment to work and sustain in. Also it is fostering digitalization by building digital infrastructures. Moreover, as for the rural interest of the country, the government in its interim budget as of 1st February 2019 has vowed to create one lakh digital villages in the next five years. So it remains to be seen how prepared is India, along with its vast set of distinct urban and rural consumers to get digitized.

Literature Review

E-payment system is a vital process that offers a secured and convenient way of transacting over the internet and turned out as an open sesame to technological advancement in world's economy (Slozko & Pello, 2015). A.Sarkar (2015) focused on the barriers that impede innovation in India's payment system. Nitsure (2014) identified the problems faced by developing countries like India in the adoption of E-banking initiatives. The major issues are: security concerns, rules, regulation and management. Zinman (2005) identified that young and educated people are more technology grokked, they are the one who use e-payments and debit cards most. Goerge (2002), Pavlou (2002) and Suh and Han (2003), determined the strong relationship between the trust and attitude towards e-commerce. Stavins(2001) identify the impact of income, network, age, gender, education, family size, number of dependent and employment on electronic payment using logit regression. He indicated that the cause of slow rate of adoption in digital payment is the cause of demand and supply related factors. Demand related factors include informational effects, whereas supply related factors include -such as institutional setups, technology adoption decisions by local banks, payment options offered by employers, availability of debit and credit card payment options in supermarkets, or average distances to the nearest bank. It was found that despite of lower processing cost electronic payments compose only a fraction of retail payments in USA. The consumer preference for payment varies with the attributes: income, education and marital status.

Objectives of the Study

1. To determine the behaviour of customers towards digital payments
2. To examine the impact of age on digital payment acceptance
3. To examine the impact of education of digital payment acceptance
4. To identify the factors influencing consumer behaviour towards digital payments

2. Research Methodology

An exploratory research followed by descriptive study. Exploratory research administered by analyzing the available literature. Descriptive research based on cross sectional study was posited to determine the customers' behaviour towards internet and digitalization. A structured, close ended questionnaire was administered and circulated among 180 respondents residing in Lucknow city on the basis of convenience sampling. The total of 157 responses was found to be usable on the bases of completeness and consistency. Besides collecting the data by personally meeting the respondent and getting the hard copy filled, online survey was also conducted where the link of the URL was send to the respondents via mails, and instant messenger. The questionnaire was divided into two parts: the first part includes demographic

profile of the respondents whereas, second part comprises of the questions allied to digital payment behaviour. The responses were generated on nominal scale and interval scale i.e.5 point likert scale indicated as: 1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree, 5- Strongly agree.

3. Analysis and Interpretation

3.1 Demographic Analysis

Age(Years)	Frequency	Percent
20-40	37	23.6
40-60	40	25.5
Above 60	80	51
Education		
Junior School	20	12.7
High School	40	25.5
Higher Secondary School	10	6.4
Graduate	21	13.4
Above Graduate	66	42

Table: 3.1.1

Table 3.1.1 shows the demographic profile of the pertinent group. The demographic profile was analyzed on two bases- age (years): 20-40, 40-60 and above 60, education: Junior School, High School Graduate, Graduate and Above Graduate. 23.6 percent of respondents belong to the age group 20-40 years, 25.5percent belong to the age group 40-60 years and remaining 51percent belong to the age group above 60 years. The education level most of the respondent was quite high, 42 percent were above graduate, 25.5 percent have studied high school remaining 12.7 percent and 6.4 percent have attended high school and graduation respectively.

3.2.1 Analysis of Influence of Demographic on Digital Behaviour
3.2.1 Impact of Age on Digital Behaviour
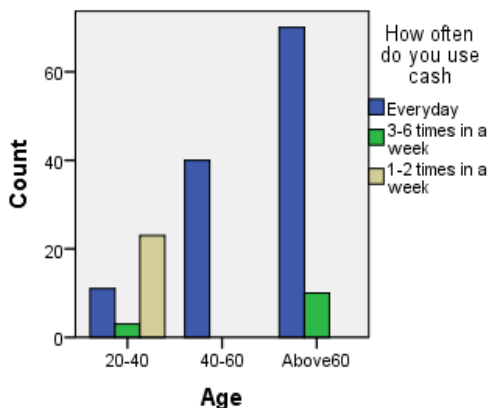
Chart 3.2.1. shows the frequency of using cash payment of different age groups. It was found that 62.16 percent people of the age group 20-40 years use cash payment one to two times in a week, 8.10 percent people from the same age group use the cash payment three to six times in a week and 29.72 percent of them use cash everyday. This shows that most of the people belonging to this age group use digital payments. 100 percent respondents belonging to the age group 40-60 years use cash everyday, whereas, 87.5 percent respondents belonging to the age group above 60 years use cash everyday and 12.5 percent of which use cash three to six times in a week.

Chart 3.2.1

Chart 3.2.2 indicates the digital payment usage frequency of different age groups. It was found that pertinent group belonging to age class 20-40 years use digital payment in the following manner- 27.02 percent people use it everyday, 35.13 percent people use digital payment three to six times in a week, 10.81 percent of them use it one to two times in a week and 27.02 percent people use it once every few months. This shows that digital payment adoption rate is also not high in generation-Y. All 100 percent people belonging to the age group 40-60 years use digital payment once every few month. Of the age group above 60 years 87.5 percent people use digital payment once every few month whereas, 27.02 percent of them use digital payment three to six times in a week. Hence, the adoption of digital payment is not proliferating. The least adoption is by generation-X followed by baby boomers.
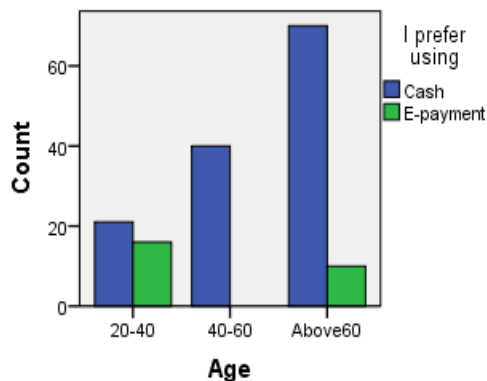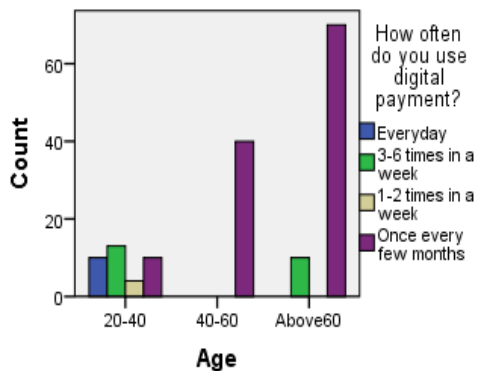
Chart 3.2.3 shows the preference towards digital and cash payment. It was found that no age group shows a major inclination towards digital payment. Generation-Y appears to be mixed bag where 56.75 percent people prefer cash payment and 43.24 percent people prefer digital payment. All the people belonging to age group 40-60 years prefer only cash payment. From the age group above 60 years 87.5 percent prefer cash payment, while only 12.5 percent prefer digital payment.

Chart-3.2.3

3.3 Impact of Education on Digital Behaviour
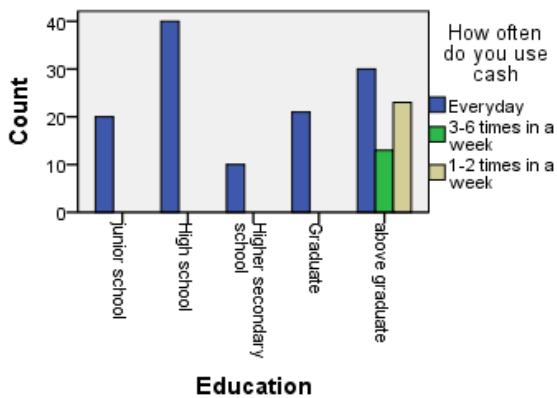
Chart 3.3.1 shows the frequency of using cash by the people belonging to different education level. It is very much clear from the chart that education does influence the preference of cash usage. People belonging to the lower level of education prefer cash payment, whereas, 34.84 percent people belonging to higher educational level use cash one to two times in a week only and 19.69 percent people use cash three to six times in a week.

Chart 3.3.2 represents the use of digital payment. It was observed that people are very skeptical about using digital payments, particularly low education level class. All the people belonging to higher secondary school or lower use digital payment once every few months. 15.15 percent of people belonging to above graduate category use digital payment everyday, the number of which is quite less. 34.84 percent people belonging to the same class use digital payment three to six times in a week. 4.54 percent of them use digital payment one or two times in a week and 45.45 percent of the same group use digital payment once every few month. This shows that adoption of digital payment is comparatively more in
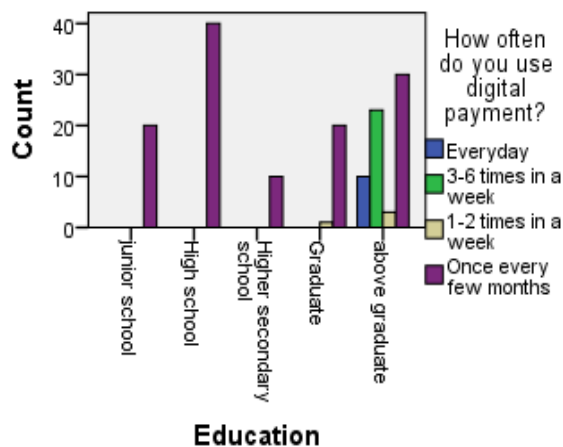
people having high education level

Chart 3.3.2
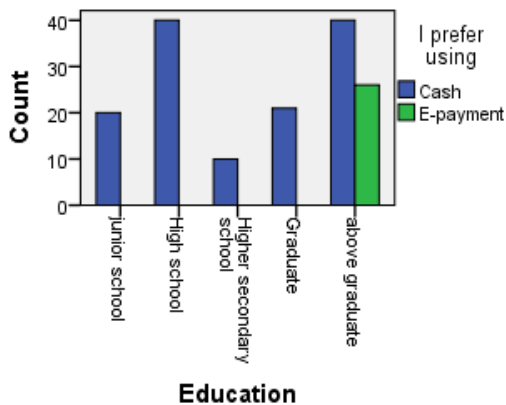
Chart-3.3.3 represents the preference of digital payment over cash payment. It was found that people with less education prefer cash payment. 39.39 percent people, belonging to above graduate educational class prefer digital payment, whereas 60.7 percent people still prefer cash over digital payment.

Chart 3.3.3

1. **Analysis of Relationship**

   Hypothesis

   $H_0 1$: There is significant impact of access authorization on digital payment behaviour

   $H_0 2$: There is significant impact of trust on digital payment behaviour

   $H_0 3$: There is significant impact of system efficiency on digital payment behaviour

   The relationship between the three unobserved variables viz-a-viz Attitude towards digital payments, Access Authorization and System Trust and System efficiency was determined by using confirmatory factor analysis. Confirmatory Factor analysis proves that items or loadings are under the construct.

Standardized Regression Weights:

			Estimate	P
Q6	<---	Digital payment behaviour	.984	***
Q3	<---	Digital payment behaviour	-.598	***
Auth1	<---	Access authorization	.820	***
Auth2	<---	Access authorization	.657	***
Trust1	<---	Trust worthiness	.963	***
Trust2	<---	Trust worthiness	.939	***
Trust3	<---	Trust worthiness	.862	***
Trust4	<---	Trust worthiness	.968	***
Effi2	<---	Sys Efficiency	-.994	***
Effi4	<---	Sys Efficiency	.411	***

Table- 3.1

Table 3.1 indicates the estimates and there corresponding p–values. '***' indicates that p-value '***' indicates the regression weight for the construct in the prediction of item is significantly different from zero at the 0.001 level. Digital payment behaviour in the prediction of Q6 and Q3 is significantly different from zero at the 0.001 level (two-tailed). Access authorization in the prediction of Auth1 and Auth2 is significantly different from zero at the 0.001 level. Trust worthiness in the prediction of Trust1, Trust2,Trust3 and trust4 is significantly different from zero at the 0.001 level. System efficiency in the prediction of Effi1 and Effi2 is significantly different from zero at the 0.001 level. Hence null hypothesis H_01, H_02 and H_03 is rejected.

Convergent Validity tells how well the items are loaded under each construct. Convergent validity can be determined by Average Variance Extract (AVE$_s$)

Convergent Validity	Digital Behaviour	Access Authorization	System Trust	System Efficiency
AVE (Value >0.5)	0.6629	0.5520	0.8722	0.5784
Convergent Validity	Established	Established	Established	Established

Table-3.2

Table 3.2 shows the convergent validity for all the constructs. The AVE value of the entire construct is greater than 0.5. Hence the convergent validity is established.

Correlation Analysis	Factor Correlation
Digital payment behaviour <---->Access authorization	-.521
Access authorization <-----> Sys Trust	.957
Sys Trust <--> Sys Efficiency	-.885
Digital payment behaviour<----> Sys Trust	-.862
Access authorization <-----> Sys Efficiency	-.850
Digital payment behaviour <----> Sys Efficiency	.767

Table3.3
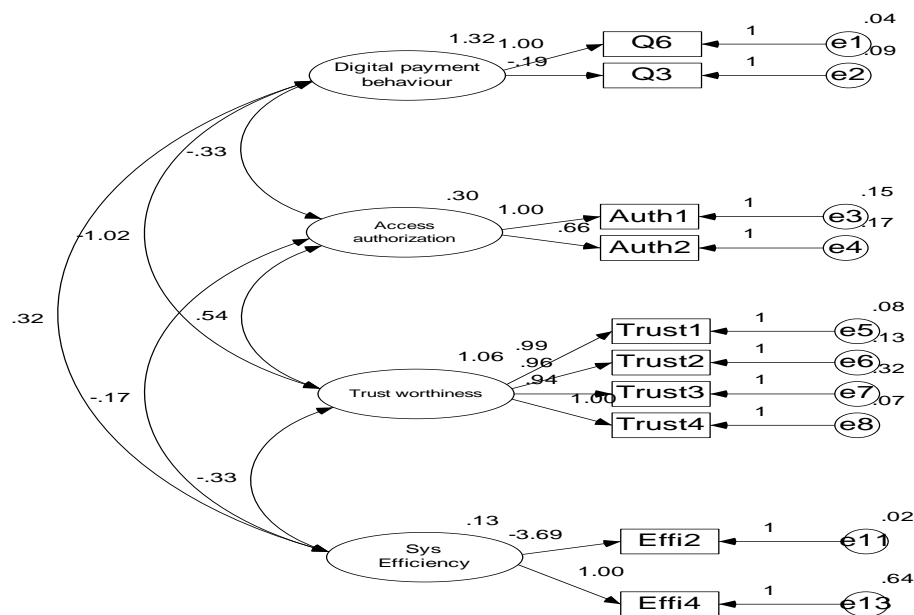
Figure-3.1

The above model of confirmatory analysis shows the estimates of correlation between the construct. Close to perfect positive correlation exist between the access authorization and system trust (r=.957). Negative correlation exist between system trust and system efficiency (r= -.885). Negative relationship exist between access authorization and system efficiency (r= -.850). Positive relationship exist between digital payment behaviour and system efficiency (r= .767).

Structural Equation Modeling (SEM) was conducted to determine the applicability of the proposed model.
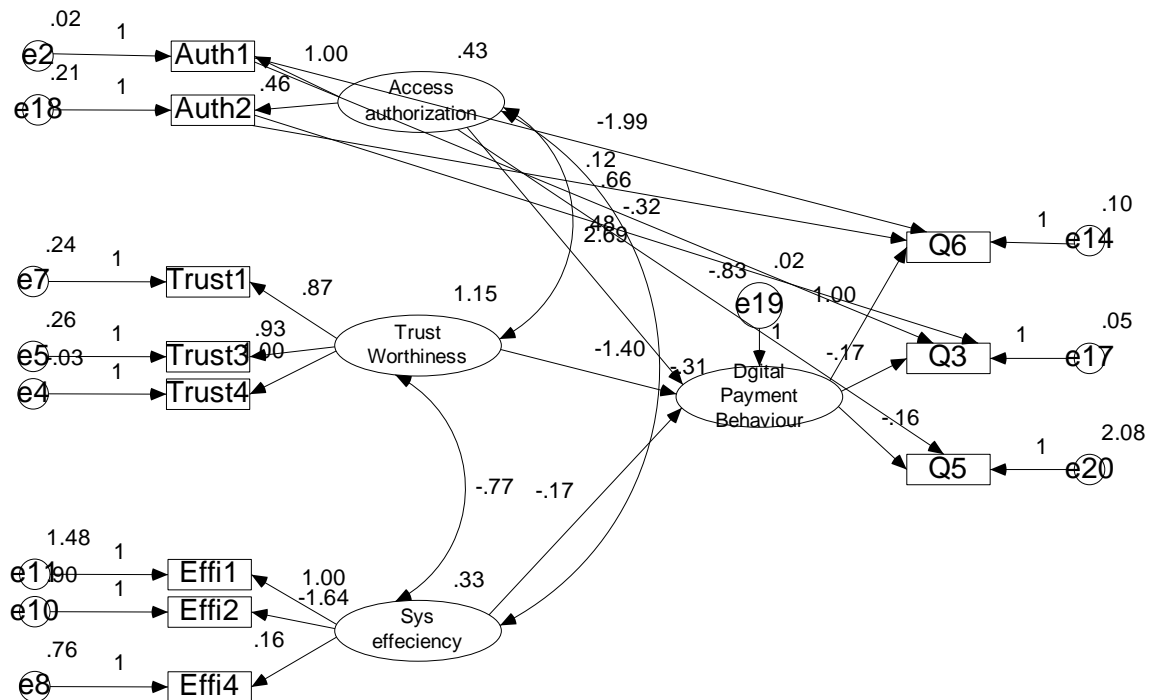
Figure 3.2

Figure 3.2 shows the proposed model for customer behaviour towards digital payments. The dependent variable 'behaviour' was dependent on three independent variables were determined- Access authentication, trust worthiness and system efficiency. Item number 'Trust 2', 'Trust 5' and 'Effi 3' were eliminated of their high standardized residual covariance > ±2. The p-value for all the estimates were <<0.05. The value of CMIN was 764.026 and p<0.5 (refer table- 3.1), which is not a good indicator of model fit. But the value of GFI was 0.907, which close to 1, also the values of NFI and CFI were 0.904, 0.907 which is also close to 1. Also the value of RMSEA was 0.03 <0.5. Out of four indicators three are representing good fit. Therefore, it shows that the above model is a kind of accurate model at examining the causal effect between the construct and can be applied to the general population of much larger sample size. This model also validates that consumer behaviour towards digital payments is influenced by Access authorization, Trust worthiness and system efficiency.

From the value of R^2 it was indicated that 68.1 percent variation in behaviour towards digital payments is caused due to trust worthiness, 11.7 percent variation is due to access authorization and 3.4 Percent variation in behaviour towards digital payment is caused by system efficiency.

1. Consumer Behaviour Towards Digital payments
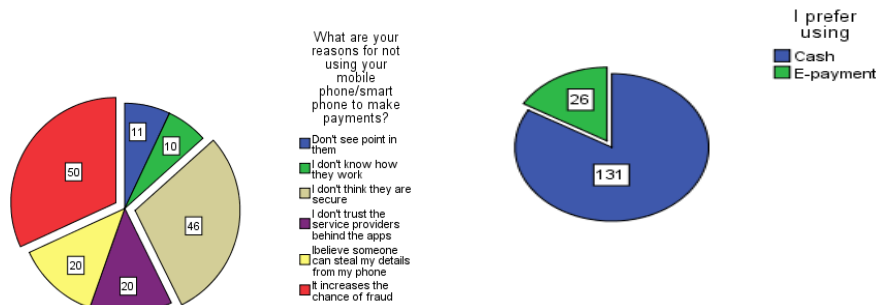
Chart- 4.1

Chart 4.1 represents the behaviour of people towards digital payments. A substantial group (31.84 percent) doesn't use digital payment because they think it increases the chances of fraud. 29.29 percent of the total sample doesn't use it as they think digital payment system is not secure. 12.73 percent respondents don't use digital payment since they believe that someone can steal their details from their phone. Other 12.73 percent don't trust their service provider. Remaining 7.00 percent people don't see any point in using digital payments whereas, 6.40 percent have no cognizance of it.

Out of total respondents 83.43 percent people prefer cash payment and only 16.57 percent prefer digital payment. The ostensive reason for refusal of digital is the dearth of security and trust towards digital system.

Findings and Suggestion

Indeed India's urge for digitalization is getting more and more with each passing day but the question is are the people ready to embrace the technology? On one hand the digitalization drive is creating appetency for the goods or services over internet but on the other hand trepidation towards unauthorized access, trust worthiness and incompetent system restraining people from harnessing technology. The study found that the variation exist in the digital payment behaviour of people belonging to different generations viz-a-viz baby boomers, generation X and generation Y. This variation is also seen in the people belonging to different education class educational level. It was found that approx 57 percent people belonging to age group 20-40 years prefer doing cash payment and only 43 percent of it uses digital payment. This number dropped to 12.5 percent when addressing the digital payment preference of people belonging to the age group above 60 years. Significant influence of education level was seen on the preference of payment. Out of total respondents only 39.40 percent people prefer digital payment and this whole array belongs to above graduate class. 62.2 percent people from the age group 20-40 years and 12.25 percent people from the age class above 60 years confirmed that they will consider making digital payment. On all only 20.10 percent people (concentrated towards higher education class) agreed that they will use digital payment this number is quite pint-sized. The main reasons for not using digital payments

were identified as- 31.84 percent people think that it increases the chance of fraud, 29.3 percent don't think inter is secure, 12.73 percent don't trust the service provider behind the apps, 12.73 believes that someone will stole their information and only 6.40 percent people don't know how digital payment works. These statistics shows that the conspicuous cause skepticism about digital payment is the fear of security. Also the study has validated three factors viz-a-viz assess authorization, trust worthiness and system efficiency that have an impact on the digital consumer behaviour.

Since security, privacy and system inefficiency is the main rationale behind resistance towards digital payment, therefore there a need to provide the secure and efficient environment.

 To build secure and efficient system some fundamental technology like 'Block Chain' should be introduced in payment system. One way to think of Block chain is as one big ledger in the cloud. When we send money to any person located outside the country's boundary, it is not the money that flies here to there. It would be a money entry in sender and receiver's ledger and money is transfer. Now the problem is apart from receiver and sender ledger there are bunch of other ledgers- ledgers owned by banks, ledgers owned by money institutions, financial institutions, regulators, insurance companies etc and each of these ledger have to be reconciled and changed. After reconciliation the possible changes are incorporated, because of so many of them it creates friction and due to this friction the time delay takes place and cost is incurred. Hence instead of this broken system we should have one universal ledger. All the banks, ledgers owned by money institutions, financial institutions, regulators, insurance companies, sender and receivers should be the participants in the ledger. Every time an entry is made every participants shall cross-check it and authenticate it. Then, only one entry would be made i.e. 'Real time entry'. This concept of single universal ledger is the heart of a block chain. So whenever a new transaction happens it gets added on as one more block in a chain of already existing chain of transactions and the transaction is authenticated by everyone. Also this block chain is protected by amongst the best cryptography algorithms available, so very difficult to hack it. Every block added is immutably linked to the last block, so if the hacker wants to change one block, he has to change the entire chain which is very difficult to do. Therefore, block chain is super secure, driven by consensus and immutability. Other important thing in block chain is since it is a chain, any event happened in the past could be traced out. And finally no one owns the chain, it is not one bank or a financial institution, it is owned by bunch of people and as an incentive to maintain the chain all the participants gets the currency called bit-coin. The concept of trust is changed in block chains, from centralized trust it is distributed trust. This distributed trust is the sole of block chain. Block chain is really useful for these four things- consensus, security, provenance and trust. Hence Block chains can be used to transform the developing country like India

Conclusion

The study concludes that despite of the urge for digitalization, the adoption rate of digital payment is substandard. Pharaonic contrast was seen in the attitude towards internet of people belonging to different age group and income class, but when it comes to the digital payment both this contrast is reduced. Most of the people irrespective of their age and education prefer to cash payment as they don't believe internet

to be secure and trust worthy. Hence there is a need to introduce some technology like 'block chain' to make the system more secure, trust worthy and efficient.

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Appendix

Q6	I would consider making digital transaction
Q3	I prefer using cash
Auth1	Companies can use personal information for any purpose other than one authorized
Auth2	Companies can share personal information about me without my permission
Trust1	Internet is trustworthy
Trust2	Internet is a reliable way for me to take care of my personal affairs
Trust3	I feel secure in digital transactions
Trust4	I trust the service providers behind the digital transaction (through smart phone)
Effi2	I am satisfied with the digital payment infrastructure of the service provider
Effi4	Digital transaction service is quick

A STUDY ON CUSTOMER PERCEPTION ON DIGITAL BANKING

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INTRODUCTION

The Promotion of online banking technology enabled the banks to enhance its operations with cost cutting effectively and efficiently in order to handle daily banking affairs via online banking channel. Customers are being facilitated by reducing their visits in banks and they can carry out their transactions via internet or ATM Machines instead of personally visiting the branches. In online business trust, security and safety are the most challenging issues for the banks. Beside them, to build and retain the customers' trust will also become a future challenge for banks especially in internet banking (Aladwani, 2001). Majority of the customers hesitate to use internet banking services because of security and privacy issues (Lee & Turban, 2001). The security problems have a large contribution to reduce customer satisfaction. The success of any new product and service is highly depending on customer acceptance and customer satisfaction. (Huang et al. 2004). In contrast the customer dissatisfaction and resistance is one of the major causes of market failure of innovation (Ram and Sheth, 1989).

Mobile banking has a great contribute in online banking revolution, which is giving a competitive edge to the banks against their rivals. Especially "Transaction Alert / Confirmation" is most demanding service by users. According to VasyaandPatrick(2006) recent development of information technology has led to major changes in the way services are delivered to the customers. Nowadays, customers are using more and more self-service options, which are more convenient and fast.

Kumar(2014) suggests that customers' growing use of digital channels for banking and their demand for an individualized experience have forced many banks to revisit their customer service efforts. In the face of increasing competition from emerging digital banks, which are redefining customer satisfaction and luring younger customers, traditional banks must leverage digital channels to create a more rewarding customer satisfaction.

Electronic banking is a major innovation in the field of banking. Earlier banking was conducted in a very traditional manner, there were no such innovations. Information revolution led to the evolution of internet, which lead to Ecommerce continued by evolution of E-banking. With the help of technology customer conduct the banking activities anywhere in the world like ATM's Debit cards, phone banking, internet banking and Bank app etc. Digital India is a campaign launched by the Government of India to ensure that Government services are made available to

citizens electronically by improving online infrastructure and by increasing Internet connectivity or by making the country digitally empowered in the field of technology.

REVIEW OF LITERATURE

Abdullah Bin Omar (2011)Customer Perception towards Online Banking Services: Empirical Evidence from Pakistan. JThe study reveals that mostly customers prefer internet banking (IB) services over branch banking due to reliability, convenience, speed, safety and security, cost effectiveness, user-friendly, and error free system. In contrast the parallel finding shows that security problems, lack of trust and knowledge, ATM machine problems etc. affect the adoption decision of customers of internet banking services. The services which are not in Pakistan e.g. Cash depositing facility through ATM machines, "SMS/E-mail Alert" Service, Transfer funds through ATM machines, Payment of utility bills through internet are found most required / demanding services by the customers in this study. This study will helps the banks that how they can improve the level of online banking services in Pakistan and what are the potential issues or services that should be introduced in society to facilitate the customer in a better way and to compete their rivals in banking industry as a whole.

MASHOOD MUKHTAR, (2015) Perceptions of UK Based Customers toward Internet Banking in the United Kingdom .it has been evaluated that customers perceive internet banking services reliable and secure. However, some of the older respondents did not feel convenient to use internet banking and they might have higher security concerns while using internet banking. The dimensions of privacy, security, convenience and time savings was perceived positively by the customers.

AMOLA BHATT (2016)Factors Affecting Customer's Adoption of Mobile Banking Services. Journal of Internet Banking and Commerce. With the rapid advances in technology and changing demographics and life-style of people, the traditional branch banking is giving way to electronic banking (e-banking) and more recently mobile banking (m-banking). However, numbers suggest that the rate of acceptance of technology is quite low. In India, as quoted by an RBI report (Report of the Technical Committee on Mobile Banking, 2014), 64 banks have commenced mobile banking operations and there are 22 million active mobile banking users, which is roughly 5% of the total bank accounts. Lack of awareness, security concerns and technical issues are considered as the major reasons behind customer resistance to mobile banking services. Hence, it is pertinent for the service providers to understand and address the needs of customers so as to optimize their mobile banking experience. The current study aims at describing the usage patterns of mobile banking customers and identifying the factors which influence their usage of m-banking.

CHANDRAWATI NIRALA & DR. BB PANDEY (2017) Role of E-Banking services towards Digital India. Government of India encourages people to move towards Cashless Economy. The study of this paper is to find role of E-Banking services in Digital India. The objectives of study are to identify Drivers of Digital Banking Transformation, contribution of Indian banks towards Digital India, facilities provided by Indian banks to make India cashless, Key barriers of Digital payment and to identify Threat for Indian bank. Technology has become a tool that facilitates banks' organizational structures, business strategies, customer services and related functions. Digitalization changes face of branch banking.

TARIQ ABBASI(2017)The Impact of Digital Financial Services on Firm's Performance:a Literature Review . This research observe that despite rapid technological advancement in DFS during the last ten years, Digital Financial Services being the factor affecting firm's performance didn't get the reasonable attention in academic literature. One of the reason is that almost all the authors limit their research to banking sector while ignoring others particularly mobile network operators (providing branchless banking) and new non-banking entrants. We also notice that newer researchers often ignore past research and investigate the same issues. This study also makes several recommendations and suggest directions for future research in this still emerging field.

VARDA SHARDHANA(Nov 2018)Digital Technology in the Realm of Banking: A Review of Literature**.**This paper reviews the theoretical literature on the growth of digital and information technology in the Indian banking industry. The stupendous advancements in digital technology have transformed the way banks operate. The commencement of the age of digital business has been disrupting the business environment and breaking out innovative and singular ways of doing business. One of the latest outcomes of this is digital banking. Digital banking technologies have escalated over the years, with the availability of a large portfolio of products such as deposits, ATMs, debit cards, mobile payments, and the like. There is an immense possibility of using the infrastructure of the digital age to create opportunities-both local and global. The increase in competition and various other challenges in the banking sector are pushing the banks to adopt new digital models that present unique sources of value to them. This paper examines the extent and the direction of the effect of digital technology in the domain of Indian banking.

UMBAS KRISNANTO(2018) DIGITAL BANKING MADE TRANSACTION MORE TRUSTED AND SECURED. This research was conducted to find out customer's response in digital banking era using TAM and UTAUT model. Questionnaires filled bank account owner who have often used digital banking. Results based previous research most customers have been able to adjust to the digital banking. There is short comings facilities in digital banking i.e. small banks still use digital banking as window dressing to attract customers, the front-page display is too confusing, often broken, security is not guaranteed. Recommendations have been given to the bank's management, as input for improvement in the future.

OBJECTIVES OF THE STUDY
1. To find the factors influencing digital banking on customer perception.
2. To elaborately analysis the customer satisfaction and digital banking.

HYPOTHESES OF THE STUDY
1. There is no significant difference among the factors influencing digital banking.
2. There is no significant influence on digital banking on customer satisfaction.

INFLUENCE ON DIGITAL BANKING ON CUSTOMER SATISFACTION
Digital banking used by the customer for many reasons. It consist of ten variables. The subsequent influence over customer satisfaction is measured through multiple regression analysis. The results are presented below

Table – 1 Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.973[a]	.947	.946	.298
a. Predictors: (Constant), DB10, DB7, DB4, DB9, DB8, DB1, DB2, DB6, DB5, DB3				

Source – computed data

The above table shows that R = .973 R square = .947 and adjusted R square = .946.It established 95% influence over customer satisfaction. The cumulative influence over the ten variables of digital banking on customer satisfaction is ascertained through the following one way analysis.

Table – 2 ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	777.071	10	77.707	873.959	.000[b]
	Residual	43.479	489	.089		
	Total	820.550	499			
a. Dependent Variable: CS1						
b. Predictors: (Constant), DB10, DB7, DB4, DB9, DB8, DB1, DB2, DB6, DB5, DB3						

Source – computed data

Table – 2 interprets that F = 873.959 P = .000 at statistically significant at 5% level. This indicates that all the ten variables cumulatively responsible for customer satisfaction. The individual influence of this variable on customer satisfaction is presented in the following co-efficient table

Table – 3 Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.307	.046		6.711	.000
	Perceived usability	-.029	.057	-.030	-.515	.607
	Perceived risk	-.058	.049	-.063	-1.187	.236
	Brand/trust	-.358	.076	-.374	-4.697	.000
	Digital quality	-.013	.049	-.015	-.273	.785
	Innovations	-.061	.072	-.060	-.845	.398
	privacy	.025	.072	.027	.355	.723
	Time saving	.310	.047	.311	6.594	.000
	Easy handling	.259	.060	.245	4.317	.000
	security	.370	.045	.417	8.144	.000
	convenience	.500	.036	.539	13.761	.000
a. Dependent Variable: Customer satisfaction						

Source – computed data

There was presented in the above table Privacy (Beta = .027 t =.355 p=.723) Time saving (Beta = -.311 t =6.594 p=.000)Easy handling (Beta = .245 t = 4.317 p=.000)security (Beta = .417   t =8.144 p=.000)Convenience (Beta = .539 t =13.761 p=.000) are statistically significant at 5% level.Perceived risk (Beta = -. 030 t =.515 p=.607),   Perceived risk (Beta = - 063 t =-1.187 p=.236)Digital quality (Beta = - .015 t =-.273 p=.785)Innovations (Beta = -.060 t =-.845 p=.398) are not statistically significant at 5% level.Brand /Trust (Beta = - .374 t =-.4.697 p=.000) is neither agree nor disagree by the customers who are using digital banking. It found that customers are using digital banking for convenience and time saving and they get satisfaction for the same.

FINDINGS AND CONCLUSIONS
The researcher finds ten factors for using digital banking. There are perceived usability, perceived risk, brand/trust, digital quality. Innovations, privacy, time saving, easy handling, security and convenience.
In the above ten factors customers are preferring digital banking for convenience and time saving than the other factors.
Customers are satisfied while using digital banking for security and easy handling.
Finally, it concludes that digital banking increase the bank's performance and increase more customers and they are very loyal for thetransactions through advanced digital banking facilities provided by the banks.

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"A STUDY ON E-COMMERCE IN INDIA"

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ABSTRACT
There are different types of online transaction has been done in Indore. Indore is education hub so there are so many students and people are come to stay here so E-commerce and online transaction play vital role in this activity. E-commerce provides multiple benefits to the consumers in form of availability of goods at lower cost, wider choice and saves time. The general category of ecommerce can be broken down into two parts: E-Merchandise & E-finance. Many companies, organizations, and communities in India are doing business using E-commerce and also are adopting M-commerce for doing business. Ecommerce is showing tremendous business growth in India. Information Technology has been playing a vital role in the future development of financial sectors and the way of doing business In Indore. Increased use of smart mobile services and internet as a new distribution channel for business transactions and international trading requires more attention towards e-commerce security for reducing the fraudulent activities. The advancement of Information and Communication technology has brought a lot of changes in all spheres of daily life of human being. E-commerce has a lot of benefits which add value to customer's satisfaction in terms of customer convenience in any place and enables the company to gain more competitive advantage over the other competitors.

This study predicts some challenges in an emerging economy.
In Indore there are different types of E-commerce transaction has been done .E-commerce involves an online transaction. E-commerce provides multiple benefits to the consumers in form of availability of goods at lower cost, wider choice and saves time. Ecommerce is showing tremendous business growth in India. Ecommerce is also showing tremendous business growth In M.P at Indore is also increasing internet users have added to its growth. India Despite being the second largest user base in world, only behind China (650 million, 48% of population), the penetration of e-commerce is low compared to markets like the United States (266 M, 84%), or France (54 M, 81%), but is growing at an unprecedented rate, adding a round 6 million new entrants every month. The industry consensus is that growth is at an inflection point. India's e-commerce market was worth about $3.9 billion in 2009, it went up to $12.6 billion in 2013. In 2013, the e-retail segment was worth US$2.3 billion. About 70% of India's e-commerce market is travel related. According to Google India, there were 35 million online shoppers in India in 2014 .E-commerce market is growing is 17 percent in financial year

Keywords:
E-commerce, information technology, customer satisfaction, business, market
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INTRODUCTION

E-Commerce or Electronic Commerce means buying and selling of goods, products, or services over the internet. E-commerce is also known as electronic commerce or internet commerce. These services provided online over the internet network. Transaction of money, funds, and data are also considered as E-commerce. These business transactions can be done in four ways: Business to Business (B2B), Business to Customer (B2C), Customer to Customer (C2C), and Customer to Business (C2B) .India has emerged as one of the major players on the new international business scene. Its unstoppable economic growth since reforms in 1991 has become the focus of attention of Researchers in the area of Indore in   international business and management. The purpose of this paper is to review the impact of e-commerce in Indore on Indian Commerce that has been published in top business and management journals, with the aim of knowing what are the most influential papers, what are the issues that have received the most attention, which are the main findings or what more needs to be done in terms of research e-commerce is a paradigm shift. It is a ``disruptive" innovation that is radically changing the traditional way of doing business Electronic commerce is a type of business model , or segment of a larger business model, that enables a firm or individual to conduct business over an electronic network, typically the Internet . E-commerce is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the Internet. These business transactions are business -to-business, business -to-consumer, consumer-to-consumer or consumer-to-business. The term e-tail is used in reference to transactional processes around online retail. E-commerce is conducted using a variety of applications, such as email, fax, online catalogs and shopping carts, Electronic Data Interchange (EDI), File Transfer Protocol, and Web services. It can be thought of as a more advanced form of mail -order purchasing through a catalogue e -Commerce is the movement of business onto the World Wide Web. The effects of e-commerce are already appearing in all areas of business, from customer service to new product design. It facilitates new types of information based business processes for reaching and interacting with customers like online advertising and marketing.

Statistical Data Collection of E-commerce in India

Growth and Prospects of E-Commerce in India:

Increasing internet and mobile penetration, growing acceptability of online payments and favorable demographics has provided the e-commerce sector in India the unique opportunity to companies connect with their customers, it said. There would be over a five to seven fold increase in revenue generated through e-commerce as compared to last year withal branded apparel, accessories, jewellry, gifts, footwear are available at a cheaper rates and delivered at the doorstep, (as per industry body Assoc ham). It is noted that the buying trends during 2016 will witness a significant upward movement due to aggressive online discounts, rising fuel price and wider and abundant choice will hit the e-commerce industry in 2016. It observed mobile commerce (m-commerce) is growing rapidly as a stable and secure supplement to the e-commerce industry. Shopping online through smart phones is proving to be a game changer, and industry leaders believe that m-commerce could contribute up to 70 percent of their total revenues. In India roughly 60 -65 per cent of the total e-commerce sales are being generated by mobile devices and tablets, increased by 50 per cent than in year 2015 and also likely to continue upwards. It noted that the browsing trends, which have broadly shifted from the desktop to mobile devices in India, online shopping is also expected to follow suit, dia's e-commerce

market was worth about $3.9 billion in 2009, it went up to $12.6 billion in 2013. In 2013, the e-retail segment was worth US$2.3 billion. About 79% of India's e-commerce market is travel related. According to Google India, there were 35 million online shoppers in India in 2014 and was expected to cross 100 million mark by end of year 2016. CAGR vis-à-vis a global growth rate of 8–10%. Electronics and Apparel are the biggest categories in terms of sales. According to a study conducted by the Internet and Mobile Association of India, the e-commerce sector is estimated to reach Rs. 211,005 crore by December 2016. The study also stated that online travel accounts for 61% of the e-commerce market. According to Google India Research, by 2021 India is expected to generate $100 billion online retail revenue out of which $35 billion will be through fashion e-commerce. Online apparel sales are set to grow four times in coming years.

Research Methodology
The paper has been written on the basis of secondary data. The secondary data were collected From published books, journals, research papers, magazines, daily newspaper, internet and official statistical documents. The study is qualitative in nature.

Types of E-Commerce Models
Electronic commerce can be classified into four main categories. The basis for this simple classification is the parties that are involved in the transactions. So the four basic electronic commerce models are as follows,

1. Business to Business
This is Business to Business transactions. Here the companies are doing business with each other. The final consumer is not involved. So the online transactions only involve the manufacturers, wholesalers, retailers etc.

2. Business to Consumer
Business to Consumer. Here the company will sell their goods and/or services directly to the consumer. The consumer can browse their websites and look at products, pictures, read reviews. Then they place their order and the company ships the goods directly to them. Popular examples are Amazon, Flipkart, Jabong etc.

3. Consumer to Consumer
Consumer to consumer, where the consumers are in direct contact with each other. No company is involved. It helps people sell their personal goods and assets directly to an interested party. Usually, goods traded are cars, bikes, electronics etc. OLX, Quaker etc follow this model.

4. Consumer to Business
This is the reverse of B2C; it is a consumer to business. So the consumer provides a good or some service to the company. Say for example an IT freelancer who demos and sells his software to a company. This would be a C2B transaction.

Historical Development of E-Commerce A timeline for the development of e-commerce:
- 1971 or 1972: The ARPANET is used to arrange a cannabis sale between students at the Stanford Artificial Intelligence Laboratory and the Massachusetts Institute of Technology, later described as "the seminal act of e-commerce" in John Mark off's book What the Dormouse Said .
- 1979: Michael Aldrich demonstrates the first online shopping system.

- 1981: Thomson Holidays UK is first business-to-business online shopping system to be installed.
- 1982: Minitel was introduced nationwide in France by France Telecom and used for online ordering.
- 1983:California State Assembly holds first hearing on "electronic commerce" in Volcano, California.Testifying are CPUC, MCI Mail, Prodigy, CompuServe, Volcano Telephone, and Pacific Telesis. (Not permitted to testify is Quantum Technology, later to become AOL.)
- 1984: Gateshead SIS/Tesco is first B2C online shopping system and Mrs Snowball, 72, is the first online home shopper
- 1984: In April 1984, CompuServe launches the Electronic Mall in the USA and Canada. It is the first comprehensive electronic commerce service.
- 1990: Tim Berners-Lee writes the first web browser, WorldWideWeb using a NeXT computer.
- 1992: Book Stacks Unlimited in Cleveland opens a commercial sales website (www.books.com) selling books online with credit card processing.
- 1993: Paget Press releases edition No. 3 of the first app store, The Electronic AppWrapper
- 1994: Netscape releases the Navigator browser in October under the code name Mozilla .Netscape 1.0 is introduced in late 1994 with SSL encryption that made transactions secure.
- 1994: Ipswitch Email Server becomes the first software available online for sale and immediate download via partnership between Ipswich, Inc.and Open Market.
- 1994: "Ten Summoner's Tales" by Sting becomes the first secure online purchase.
- 1995: The US National Science Foundation lifts its former strict prohibition of commercial enterprise on the Internet.
- 1995: Thursday 27 April 1995, the purchase of a book by Paul Stanfield, Product Manager for

CompuServe UK, from W H Smith's shop within CompuServe's UK Shopping Centre is the UK's first national online shopping service secure transaction. The shopping service at launch Featured W H Smith, Tesco, Virgin Megastores/Our Price, Great Universal Stores (GUS), Interflora, Dixons Retail, Past Times,PC World (retailer)and Innovations.

- 1995: Jeff Bezos launches Amazon.com and the first commercial-free 24-hour, internet-only radio stations, Radio HK and Net Radio start broadcasting. EBay is founded by computer programmer Pierre Omidyar as Auction Web.
- 1996: IndiaMART B2B marketplace established in India.
- 1996: ECPlaza B2B marketplace established in Korea.
- 1998: Electronic postal stamps can be purchased and downloaded for printing from the Web.
- 1999: Alibaba Group is established in China.Business.comsold for US $7.5 million to e-Companies, which was purchased in 1997 for US $149,000. The peer-to-peer file sharing software Napster launches.ATG Stores launches to sell decorative items for the home online.
- 2000: The dot-com bust.
- 2001:Alibaba.com achieved profitability in December 2001.

- 2002: eBay acquires PayPal for $1.5 billion. Niche retail companies Mayfair and NetShops are founded with the concept of selling products through several targeted domains, rather than a central portal.
- 2003:Amazon.com posts first yearly profit.
- 2003: Bossgoo B2B marketplace established in China.
- 2004:DHgate.com, China's first online b2b transaction platform, is established, forcing other b2b sites to move away from the "yellow pages " model.
- 2007:Business.com acquired by R.H. Donnelley for $345 million.
- 2009:Zappos.com acquired by Amazon.com for $928 million. Retail Convergence, operator of private sale website RueLaLa.com, acquired by GSI Commerce for $180 million, plus up to $170 million in earn-out payments based on performance through 2012.
- 2010: Groupon reportedly rejects a $6 billion offer from Google. Instead, the group buying websites went ahead with an IPO on 4 November 2011. It was the largest IPO since Google.
- 2011: Quidsi.com, parent company of Diapers.com, acquired by Amazon.com for $500 million in cash plus $45 million in debt and other obligations.GSI Commerce , a company specializing in creating, developing and running online shopping sites for brick and mortar businesses, acquired by eBay for $2.4 billion.
- 2014: Overstock.com processes over $1 million in Bit coin sales. India's e-commerce industry is estimated to have grown more than 30% from 2012 to $12.6 billion in 2013.US eCommerce and Online Retail sales projected to reach $294 billion, an increase of 12 percent over 2013 and 9% of all retail sales.Alibaba Group has the largest Initial public offering ever, worth $25 billion.
- 2015:Amazon.com accounts for more than half of all ecommerce growth,selling.ince 2014, the Government of India has announced various initiatives namely, Digital India, Make in India, Start-up India, Skill India and Innovation Fund. The timely and effective implementation of such programs will likely support the e-commerce growth in the country. Some of the major initiatives taken by the government to promote the e-commerce sector in India are as follows:

- In order to increase the participation of foreign players in the e-commerce field, the Indian Government hiked the limit of foreign direct investment (FDI) in the E-commerce marketplace model for up to 100 per cent (in B2B models).
- As of August 2018, the government is working on the second draft of e-commerce policy, incorporating inputs from various industry stakeholders.
- The heavy investment of Government of India in rolling out the fiber network for 5G will help boost ecommerce in India.
- In the Union Budget of 2018-19, government has allocated Rs 8,000 crore (US$ 1.24 billion) to Baronet Project, to provide broadband services to 150,000 gram panchayats
- In February 2019, the Government of India released the Draft National e-Commerce Policy which encourages FDI in the marketplace model of e-commerce. Further, it states that the FDI policy for e-commerce sector has been developed to ensure a level playing field for all participants. According to the draft, a registered entity is needed for the e-commerce sites and apps to operate in India.

Advantages to Society

- Customers need not travel to shop a product, thus less traffic on road and low air pollution.
- E-commerce helps in reducing the cost of products, so less affluent people can also afford the products.
- E-commerce has enabled rural areas to access services and products, which are otherwise not available to them.
- E-commerce helps the government to deliver public services such as healthcare, education, social services at a reduced cost and in an improved manner.

Technical Disadvantages

- There can be lack of system security, reliability or standards owing to poor implementation of e-commerce.
- The software development industry is still evolving and keeps changing rapidly.
- In many countries, network bandwidth might cause an issue.
- Special types of web servers or other software might be required by the vendor, setting the e-commerce environment apart from network servers.
- Sometimes, it becomes difficult to integrate an e-commerce software or website with existing applications or databases.
- There could be software/hardware compatibility issues, as some e-commerce software may be incompatible with some operating system or any other component.

Convenience

E-Commerce has become the preferred method of shopping for many people. They love the ease with which they can shop online from their home at any time of the day or night. Purchasing options are quick and convenient with the ability to transfer funds online. Consumers save time and money by searching for items and making their purchases online. It can take several days of physically going from location to location, costing time and fuel, to purchase a hard-to-find item.

Efficiency

ECommerce is an efficient retail method for business transactions. Start-up costs for establishing an E-Commerce business is far less than expanding your business with more brick and mortar locations. Fewer licenses and permits are required to start an online business than that of a physical store location. You will also save money by using fewer employees to perform operations such as managing inventory and billing customers. You won't have to search for an appropriate geographic location or worry about paying high utility costs for the facility.

Privacy

Some consumers are reluctant to embrace eCommerce because of privacy issues. Making an online purchase often requires disclosing personal information such as an address, telephone number and banking or credit card account information. While many people feel making an online purchase does not compromise their personal information, some still prefer not to take a chance of having their account information accessed by a third party, and will only make their purchases at a storefront operation.

Unfamiliarity

There are always going to be people who prefer to do their shopping at a brick and mortar location. Some people are resistant to change and may not want to embrace eCommerce due to a lack or knowledge about the process or a general reluctance to purchase an item they cannot physically examine. If the product does not meet the customer's expectations in some way, such as being the wrong size or defective, he must then spend time sending it back and waiting for the replacement product to arrive.

Conclusion

Growth of e-commerce depend to a great extent on effective IT security systems for which necessary technological and legal provisions need to be put in place and strengthened constantly. While many companies, organizations, and communities in India are beginning to take advantage of the potential of e-commerce, critical challenges remain to be overcome before e-commerce would become an asset for common people. With the explosion of internet connectivity through mobile devices like Smartphone and tablets, millions of consumers are making decisions online and in this way enterprises can build the brand digitally and enhance productivity but government

policies must ensure the cost effective methods/solutions. E-Commerce in India is destined to grow both in revenue and geographic reach. The challenge of establishing consumer trust in e -commerce poses problems and issues that need further research

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Impact of Total Quality Management and Service Quality in the Banking Sector

NeerajMehra

Abstract

After the successful implementation of TQM in manufacturing it is now being extensively applied in service sectors including banks, to improve business performance. Keeping this in view, the purpose of this paper is to present a detailed overview of the role of service quality and Total Quality Management (TQM), and its critical dimensions in the banking sector. A detailed review of the literature on TQM and service quality concepts was carried out in context of the banking sector. The study further explored the experience of TQM implementation in banks adopting this approach. The findings indicate that to ensure successful implementation of TQM in the banks, there are certain critical dimensions which needs to be addressed, viz: management commitment and support towards TQM, motivating and training of employees, and monitoring of customers' requirement through feedback. Beside this, it was also found that service quality is an important construct in banking sector and identifies four broad conceptual categories related to service quality. The finding will provide an understanding of the role of TQM and service quality in banking sector and it also provides useful direction for future research.

Keywords: Total quality management; Banking sector; Servicequality; Service industry

Introduction

Liberalization and globalization of the banking sector has created an era of fierce competition, as a result of which service management and quality performance is expected to assume an increasing important role in these industries [1]. Banks can become stronger and effective only if they come out with better customer service, quality, costs, and innovation [2]. Today, customers have a wide choice of service providers and they would opt for only the best service providers in terms of quality, reliability, and profitability and who are at par with international standards. Therefore, the quality of service plays a dominant role and is a primary factor in ensuring the survival of the service provider in the global market. The whole focus is now concentrated on providing services to customer beyond his expectations. This concept is applicable to all service industries and has given birth to the concept of TQM in service sector [1,3].

The popularity of TQM in manufacturing sector has encouraged a number of organizations to view its benefits and effect on organization performance. Several research papers have investigated the framework of successful TQM implementation [4-7].

The service quality of banks, especially perceived service, plays an important role in high-involvement industries like banks [1,8]. Leading academicians and researchers strongly believe that providing quality service to customers is not only the most important and effective factor for customer satisfaction but also the essential criterion that measures the competitiveness of a service organization like banks [1,8-11].

For survival, it is mandatory to provide best service quality and it is also viewed as pre-requisite to success of banking sector [12]. Many studies have proved that the performance of banks is significantly and positively linked with the service quality [13-15], and to achieve service quality in the banking sector, the TQM is highly essential [8,16].

Need of study

Extent literature review suggests that voluminous research work has been done on the quality of services and relationship between service quality and organizational performance through TQM, but onlya limited number of studies on TQM and service quality in the banking sector have been carried out. Researchers like Ahmed [17], Neyer [18], Sureshchandar et al. [19], Meyer and Dornach [20] have suggested the need of the present study to understand how banks can perform in a better way and what critical dimensions for success are so that they could be implemented to improve their financial performance, fulfill customer requirements and excel in quality of service.

Aims and scope

This study aims to present an overview of TQM in the banking sector together with the role of service quality in it so as to achieve organizational excellence. The study also identifies the key (critical) dimensions that help in the implementation of TQM in the banking sector. This study is a contribution to the academic work and attempts to provide a useful overview of TQM implementation and service quality in the banking sector.

Further, the paper is organized as follows. The next section presents TQM and service quality approaches followed by review of service quality in the banking sector. The subsequent section presents the review of TQM implementation together with the identification of critical dimensions for TQM in the banking sector. The final section discusses the conclusions of the present study along with the managerial implications and scope of future research.

TQM and service quality

The concept of service quality has emerged from TQM philosophy and now it is treated as an essential criterionfor effective TQMimplementation. The literature review suggested that service quality can be categorized into number of ways such as customer service quality; online service quality; banking service product quality and automated service quality (explained in next section) [21,22] with the common aim to achieve customer satisfaction, improved financial performance, and competitiveness as shown in (Figure 1). Moreover, the figure also depicts that service quality is a multidimensional construct rather than having uni-dimensional meaning.

Also, literature review further shows that measuring service quality is not an easy task and lot of problems are there in measuring it. Most forms of measurement of service quality focuses on customer satisfaction. For instant, Cronin and Taylor [23,24], argue that measuring service quality using a performance-minus-expectations (SERVQUAL) basis is inappropriate and suggests that performance-only (SERVPERF) measurement is a better method. However Parasuraman et al. [25], (PZB model) contend that the SERVQUAL scale using the

expectations/performance gaps method is a much richer approach to measuring service quality and augment their earlier assertion [26,27] that service quality is a multidimensional rather a uni-dimensional construct.

Brown et al. [28], highlights the challenges in conceptualizing and particularly measuring SERVQUAL using expectations and perceptions difference scores and proposed an alternative non-difference score approach as a more efficient way to measure service quality.

Nevertheless, banks reported that TQM leads to improvement of service quality [8,29], bearing in mind the difficulty in adequately measuring the service quality and effect of TQM in service sector, they regularly conducted a customer satisfaction survey to evaluate their performance against past performance and benchmark themselves against their main competitors. In this way they continuously improve their service quality, involve and motivate their employees and empower them in decision making, thus leading to perfect implementation of TQM program in their organization.

Service quality in banking

Across all service industries, service quality remains a critical issue in maintaining and propagating business in the competitive marketplace To survive in a highly competitive service environment, it is apparent that service industries need to provide customer with high quality services. Customer today demand quality and from there point of view, quality is nothing but an integral and expected part of service, that is service quality [31].important aspect in the banking industry. Further, it is evident that over the years, bank customers' perception of service quality has been changed tremendously. Today, quality includes a commitment towards continuous improvement and service relationships with customers. Also, the need for technology based services, new and improved product services, and e-services are also viewed as important aspects of banking service quality that supports improved and superior quality services provided to customer. Hence, these are the areas where banks have to focus upon in order to satisfy their customers.

Based on the literature review, the authors have identified the following four broad conceptual categories related to banking service quality:

- Customer service quality.
- Banking service product quality.
- Online/e-service quality.
- Automated service quality.

Customer service quality: Banking is a high involvement industry.Customers, whether at the retail or corporate level have always been important for banks. Customer satisfaction is highly related with service quality as service quality improves the probability of customer satisfaction [5], this results in commitment, intent to stay (customer retention), creation of a mutually rewarding relationship (bond) between the service provider and the user, increased customer tolerance for service failure and positive word-of-mouth advertising about the organization [32-

34]. Banks now know that delivering quality service to customer is essential for success and survival in today's global and competitive banking environment [35].

In the era when intense competition is being greatly facilitated by technology, the need of providing adequate service quality will necessitatethat banks have to focus attention on issues of improving, measuring and controlling their service quality and efficiency. Banking industries therefore should emphasize deeper penetration of the existing customer database. The data about customer needs and behavior enables organizations to identify today's key customer, develop relations with tomorrow's customers and estimate their future investment opportunities.

Banking service product quality: The bank product qualityis primarily associated with product variety and diverse features. Banking service product quality plays a significant role in determining customer's perceptions of the overall banking service quality. Banks have increased emphasis on marketing a wide array of financial services in order to survive in the market due to tough competition [36]. Dixon [37], also argued that the key of getting more customers for the banks through the online service is not the attraction of the internet itself but the product offered to the customers. Bank customers wants variety of functions at one site and with ease like financial transactions, paying bills electronically and automatically, viewing their balance, monthly bank statements, purchasing shares and insurance, home loans with minimum rate of interest, purchasing cars and lands. Although banking service product quality is an intangible asset, it contributes to the competitive advantage in the banking industry. Therefore, it should be noted that continuously introducing and innovating the variety of banking service product quality to the current hi-tech customers can have unlimited access to financial information and enjoy a wider range of choices in selecting competitive products and financial institutions than ever before [38].

Online/internet/e-service quality: Theconcept ofe-serviceemerged from the growth of the internet and information systems. The growth in internet-based services has changed the way that banks and customers interact [39]. E-service is conceptualized as an interactive information service that provides a means to organizations that can build its service offerings and develop a competitive advantage [40]. The basic reason behind development of online services was the cost reduction and to delight customers through automation [41]. Although firms gained efficiencies from online business/e-commerce/selling online, their failure to focus on customer needs and wants, resulted in poor online service performance [42]. The article by Liu and Arnett [43], considered the four quality factors as major ingredients for the success of website as: system use; system design quality; information quality and playfulness. Ribbink et al. [44], found five dimensions for e-service quality: assurance, ease of use, e-scape, responsiveness and customerization. Herrington and Weaven, examined four e-service quality dimensions: efficiency, fulfillment, availability and privacy. As for internet banking, Sathye [45] found two factors such as "difficulty in use" and "security concern" which are important reasons for consumers not opting for internet banking services.

Through this analysis it is concluded that the service quality features of internet/online banking which are critical for enhancing customer satisfaction such as the speed to download; content; design; interactivity; navigation; and security must be continuously improved.

Automated/technology service quality: Automated servicequality is defined as the customer's overall evaluation of the excellence of services provided through electronic networks such as the internet, ATM, and telephone banking [22]. Customer evaluation of automated service option and their intention to use a particular option are directly affected by their perception of the attributes associated with that optionThe overall customer perception of automated service quality can be established through the quality of every automated delivery channelMany researchers have identified ATM, internet, and telephone banking as the principal automated delivery channels for retail banking

Moreover, Dabholkar [47] argue that when the customer is in direct contact with the technology there is a greater control such as with internet banking, however, if there is no direct contact, such as with telephone banking, it is assumed that there is less control perceived by the customer during this transaction. Researchers also claims that reliability and user-friendliness with faster and more efficient service are important attribute in the evaluation of technology based servicesOverall, the need for technology to support superior service quality is viewed as very important factor for managing total quality in the banking sector.

TQM implementation in banking sector

This section reviews the implementation of TQM in banks. Use of TQM in the banking is not too old, earlier studies shows that TQM approach in the banking is a recent trend and is showing better performance after its implementation [4]. TQM, which is about total customer service and continuous customer satisfaction, is applicable to almost all service industries including banks where the customer is treated as king. In fact, customers in service industries, especially in the banking, are rather more sensitive to quality and delivery of service than their manufacturing counterpart as they are in direct contact with the service providers [48]. Therefore, adoption of TQM program in the banking sector may be one of the best alternatives that care about improved service quality and higher.Nevertheless, banks reported that TQM leads to improvement of service quality [8,29], bearing in mind the difficulty in adequately measuring the service quality and effect of TQM in service sector, they regularly conducted a customer satisfaction

A paper published in 2007 examines the critical success factors of TQM implementation in the UAE banking sector. 16 factors were found to be critical to TQM implementation success [8]. The factors are: top-management support; strategy; continuous improvement; benchmarking; customer focus; quality department; quality system; human resource management; recognition and reward; problem analysis; quality service technologies; service design; employees; servicescapes; service culture; and social responsibility.

Another study on assessing the need of TQM in the banking sector of the Northern Cyprus published in *Journal of TransnationalManagement* focused on implementing TQM principles in TurkishCypriot banks [50]. He found that there is a need for updating and implementing new rational management methods followed by motivation and training of employees and employers. Further, he argued that continuous monitoring of customer satisfaction is also necessary to make TQM more effective.

A recent study published in 2009 presents the important total quality service factors in Indian commercial banks and examines the level of implementation of TQM practices in three groups of Indian banks [1]. The study reveals that the important TQM factors are:

Top-management commitment

customer satisfaction together with retaining its customers.

A paper published in *Total Quality Management Journal* examines six case studies and concludes with key factors that led to successful

- Human resource management.
- Technical and important systems.
- Customer focus.
- Employee satisfaction.
- Service culture.
- Social responsibility.
- Servicesacpes.

Finally, a research study by Li et al. [50], surveys licensed bank in Hong Kong on the use of quality management practices. They tried to analyze the current status of quality management initiatives in Hong Kong and also compare the results with those from UK financial institutions in 1994. The result shows that they have 68 percent success rate for quality initiatives. They have also gained customer satisfaction,efficiency, and quality awareness. They tend to devote more effort in meeting service standards and providing prompt services.

Similar studies on TQM and service quality in the banking sector by Joseph and Stone [2,5,15,51] are of interest too.

Conclusions

As the banking industries become more involved in implementing TQM and service quality concepts, questions like which key practices should be accentuated and how should the TQM be implemented in the banks to achieve desired outcome of customer satisfaction, improved financial performance, and providing better competitiveness, needs to be answered. This paper seeks to provide answers to these questions.

From the review of literature it was found that several dimensions are responsible which are critical for success of TQM in the banking sector. In order to ensure a successful implementation of TQM in the banks, there is a need to motivate employees to improve the level of services provided by them. Also, appointment of qualified and competent managers will successfully contribute to the management of the banks together with giving enough training and education to employees so that they understand specific quality policy and TQM strategy. Lastly, monitoring the customer satisfaction and taking the feedback frequently would further improve the performance of the banking sector. Above all there is a need of top-management commitment towards TQM and giving full support for its successful implementation.

Many authors have identified different service quality dimensions which are associated with the banking sector. Present study categorizes these dimensions into four groups which are directly responsible for effective TQM implementation in the banking sector.

It is concluded that if these service quality attributes are taken care of, that will result in excellence in the banking performance.

To summarize, TQM is essential to the banking sector in particular and other service-oriented organizations in general to sustain competitive advantage. The result of TQM often takes time and is a long-term process. But TQM is a step in the right direction.

Managerial implications

The banking sector has maintained good progress with the advent of new service technologies; value added services, and creation of new banks. At this juncture, the present study could help the managers of the service organizations:

- To focus on understanding the needs of the customers and strive to provide the product and services that fully meets the same in order to survive in this highly competitive industry.
- To pay attention on different banking service quality and continuously improve them for customer satisfaction and retention.
- To update themselves in using different quality improvement tools and techniques in the banking sector to gain competitive advantage.

The findings of the present study suggest some directions for further research. More extension of this paper could take the form of replicating the study in other service industries such as healthcare; education; IT/IS etc. and also can use the findings of the present research as a hypothesis for a survey research using data to develop

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Returns and Volatility Dynamics of Select Indian Power Sector Stocks

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ABSTRACT

The present study is an attempt to characterize the nature of return and volatility dynamics in the selected power sector stocks. The study has used daily closing prices data for the period from January 04, 2011 to December 31, 2018. All the stocks show the stylized facts of fat tails, volatility clustering and volatility persistence. GARCH model suggests the nature of conditional volatility is similar among stocks. GJR-GARCH suggests that asymmetric response is present only in Nifty 50 and TATAPOWER. On the other hand, EGARCH reveals that all stocks have asymmetric response of volatility. However, the positive significant asymmetric term, γ, in EGARCH is puzzling. It is because in most cases volatility rises when stock prices decline and positive significant γ means that volatility rises more when prices rise as compared to when prices decline. Granger causality based on bivariate VAR suggests that past returns of Nifty 50 are helpful for forecasting returns of all stocks except DANIPOWER. Further, Granger causality on conditional variance series indicates that past conditional variance of POWERGRID influences most of the stocks. Understanding returns and volatility structure is important for arbitrageurs, speculators and hedgers. The knowledge about volatility dynamics of any asset can help in making better investment decisions.
Keywords: Power sector, Volatility Spillover, Granger Causality.

Introduction

Stock market is called barometer of economy. The health of any economy can be gauged by the functioning of its stock market. If economy is doing well, then stock prices rise and during bad times stock prices decline. Besides, stock prices fluctuate violently during times of uncertainty. From announcement of dividend to change in management, everything has a bearing on the stock prices. Stock prices are directly affected by the growth of the economy which in turn depends on the growth of the infrastructure sector.Power or electricity is an essential component of the infrastructure sector of an economy. It is one of the key inputs which affect the growth of a country. According to the 2017-18 report of the Central Electricity Regulatory Commission (CERC), the installed power generation capacity in India witnessed a compounded annual growth rate (CAGR) of 10 per cent during the period 2008-09 to 2017-18. During the same period, the CAGR in gross power generation was 6 per cent. As Indian economy continues on its

growth trajectory, the infrastructure sector especially the power sector will also grow. Thus, to participate in the growth of the power sector, investors can buy shares of power sector stocks. Towards this end, understanding the risk-return profile of power sector stocks is important. In this backdrop, the present study is an attempt to characterize the returns and volatility characteristics of selected power sector stocks in India.

Data

The present study has used daily closing prices of eight power sector stocks included in Nifty 50 index for the period from January 04, 2011 to December 31, 2018. The data is collected from Yahoo India Finance (https://in.finance.yahoo.com/).

For analysing the data, the study has used the following R packages: aTSA, ggplot2, MSBVAR, quantmod, rugarch and xts

Methodology

As a first step, the time series under consideration are studied for presence of unit roots. If the series has a unit root, then it is called non-stationary series. Since, regression analysis of non-stationary series is spurious, it is necessary to convert the non-stationary series into stationary. For finding out the presence of unit root, the Augmented Dickey Fuller test is used (Dickey and Fuller, 1979). If the series is found to have a unit root, i.e., non-stationary, then first difference is taken to make the series stationary as follows:

$R_t = \ln(P_t) - \ln(P_{t-1})$

where

P_t = price at time t

R_t = continuously compounded return at time t

GARCH Models

The classical regression models assume that error term has constant variance. However, Engle (1982) have shown that assets returns exhibit some stylized characteristics of volatility clustering called autoregressive conditional heteroscedasticity commonly known as ARCH effects. ARCH effect is the tendency of small changes following small changes and large changes following large changes. As a result of this, the variance of the error term is not constant over time. Therefore, the usual OLS cannot be used. Engle (1982) suggested ARCH model to capture this behaviour of stock market returns. Under ARCH/GARCH family of models, two regression equations are used: the mean equation, and the variance equation. The simplest ARCH model is given by:

$R_t = \mu + \varepsilon_t [\varepsilon_t \sim N(0, \sigma_t^2)]$ … … Mean Equation
$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2$ … … Variance Equation

where

R_t = daily return defined as $R_t = \ln P_t - \ln P_{t-1}$ (P_t is price level at time t)

μ can take any form (generally taken to be constant)

ε_t = error term

ω = constant

Further, for the above ARCH model to be meaningful $\omega > 0$ and $0 \leq \alpha < 1$ (Brooks, 2008).

Before using an ARCH model, it should be tested whether an ARCH model is actually required. For this purpose Engle (1982) has suggested a Lagrange Multiplier test often called as ARCH-LM test. The ARCH-LM is based on the squared residuals from the OLS. Specifically the test uses the following functional form:

$$\varepsilon_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots \ldots \ldots \ldots + \alpha_p \varepsilon_{t-p}^2 + \nu_t$$

where

ε_t = residual from the first stage regression that is $R_t = \mu + \varepsilon_t$

The test statistic is given by TR^2 and is distributed as $\chi^2(p)$. The null and alternative hypotheses under the ARCH-LM test are as follows:

$H_0: \alpha_1 = \alpha_2 = . \ldots \ldots \ldots = \alpha_p = 0$

$H_1: \alpha_1 \text{ or } \alpha_2 \text{ or } \ldots \ldots \ldots . \text{ or } \alpha_p \neq 0$

In other words, the null hypothesis states that there are no ARCH effects, i.e., residuals are homoscedastic. If the null hypothesis is rejected then only an ARCH model is required otherwise simple OLS will be sufficient.

It is often seen that to capture the entire dynamics of volatility clustering one lag is not sufficient and therefore a large number of lags are required. One problem with large number of lags is that the non-negativity condition is likely to be violated. This limitation of ARCH models is overcome by Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model proposed by Bollerslev (1986). In a GARCH model the variance equation is given as:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2$$

The above model is called GARCH (p,q) because it has got p GARCH terms (previous fitted variance, i.e., σ_{t-i}^2) and q ARCH terms, i.e., ε_{t-i}^2. However, GARCH (1,1) is sufficient to capture the entire dynamics of volatility clustering. The GARCH (1,1) is given by:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

The above GARCH model is meaningful if $\omega > 0$, $\alpha > 0$, $\beta \geq 0$ and $\alpha + \beta < 1$.

One problem with GARCH model is that it assumes symmetric response of volatility. Since, only squares are used, hence, positive or negative errors, all become positive. However, it is commonly observed that positive and negative shocks have differential effect on volatility. This differential influence of positive/negative shocks (error) is referred to as asymmetric response of volatility. To capture this asymmetric response of volatility, two models are mostly used.

GJR Model

The GJR model is named after Glosten, Jaganathan and Runkle (1993). Under this formulation the variance equation is as follows:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1}$$

where

$$I_{t-1} = \begin{cases} 1 \text{ if } \varepsilon_{t-1} < 0 \\ 0 \text{ otherwise} \end{cases}$$

The above model is meaningful if $\omega > 0$, $\alpha > 0$, $\beta \geq 0$ and $\alpha + \gamma \geq 0$. Further, for leverage/asymmetric effect to be present γ should be more than 0 and statistically significant.

EGARCH Model

Another formulation of asymmetric GARCH model is proposed by Nelson (1991). The simplest EGARCH (1,1) is given by:

$$\ln(\sigma_t^2) = \omega + \alpha \left[\frac{|\varepsilon_{t-1}^2|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{\varepsilon_{t-1}^2}{\sqrt{\sigma_{t-1}^2}}$$

One advantage of the EGARCH model is that it does not require imposition of non-negativity conditions because $\ln(\sigma_t^2)$ is modelled. For asymmetries to be present, γ should be negative and statistically significant.

Granger Causality

For understanding the returns and volatility dynamics of the selected stocks, the present study has used Granger causality. Granger (1969) stated that a series X_t is said to cause Y_t if lags of X_t help in better forecasting the present values of Y_t than past values of Y_t alone.

$$Y_t = \phi_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{i=1}^{p} \beta_i X_{t-i} + \epsilon_t$$

$$X_t = \psi_0 + \sum_{i=1}^{p} \gamma_i Y_{t-i} + \sum_{i=1}^{p} \delta_i X_{t-i} + \epsilon_t$$

In the above set of equations, if all β_i are zero, then it means that X_t does not granger cause Y_t. Similarly, if all δ_i are zero, then it implies that Y_t does not granger cause X_t. For understanding the return and volatility dynamics, Y_t and X_t are replaced by returns and volatility series respectively.

Empirical Results

Figures1 and 2 depicts the graphs of the log of closing prices and returns respectively of the selected 8 power sector stocks and Nifty 50 for the period Jan 04, 2011 to Dec 31, 2018. From the figures it can be witnessed that the log prices (level series) are non-stationary while returns (first difference series) are stationary. The statement that the series under consideration are stationary/non-stationary is examined by conducting a formal test i.e. Augmented Dickey Fuller Test. The null hypothesis for ADF test is that the data has unit root or the data is non-stationary.

Figure 1: Time plot of log of closing prices

Figure 2: Time plot of daily log returns (first difference of closing prices)

Table I presents the results of ADF test. An examination of the table I suggest that all the series in their level are non-stationary because the ADF test statistic is less than the critical value in absolute terms at 1% level of significance. Therefore, the hypothesis of non-stationarity (unit root) cannot be rejected. Similarly, on the basis of ADF test results presented in table I for returns, it can be concluded that for all the series returns (first difference series) are stationary.

Table I. Results of ADF Test for Unit Root

Stock	Test stat for levels	Test stat for first difference
NIFTY 50	-0.4320	-30.5018
ADANIPOWER	-2.5888	-29.0442
JPPOWER	-0.7812	-30.0878
NHPC	-2.4957	-30.7384
NTPC	-3.4908	-31.7852
POWERGRID	-0.9883	-32.3037
RPOWER	-1.7536	-29.0302
SJVN	-1.6622	-31.6466
TATAPOWER	-3.1738	-32.7744

[Note. 1% critical value for ADF test is 3.43.]

Table II presents the descriptive statistics for the individual stocks and Nifty 50. As is generally expected, daily % return for almost all the series is close to zero. An examination of minimum and maximum values together with standard deviation reveals that all the 8 stocks are more volatile than Nifty. Among the stocks, JP Power is most volatile because its standard deviation is highest. Skewness for ADANIPOWER, JPPOWER and SJVN is positive and negative for NHPC, NTPC, POWERGRID, RPOWER and TATAPOWER. As is known that the skewness and kurtosis for a standard normal distribution are 0 and 3 respectively, the series under consideration seem different from the normal distribution.

Table II: Descriptive Statistics

	NIFTY 50	ADANIPOWER	JPPOWER	NHPC	NTPC	POWERGRID	RPOWER	SJVN	TATAPOWER
Observations	1952	1952	1952	1952	1952	1952	1952	1952	1952
Mean	0.0291	-0.0480	-0.1691	-0.0056	-0.0147	0.0360	-0.0878	0.0052	-0.0280
Median	0.0394	0.0000	-0.1467	0.0000	-0.0296	0.0249	0.0000	0.0000	-0.0952
Maximum	3.7380	22.5229	25.6462	12.8028	10.1090	6.9721	12.3406	12.6659	11.8911
Minimum	-6.0973	-19.7643	-17.1610	-27.6166	-12.4886	-11.8573	-14.1335	-6.8993	-16.2519
Std. Dev.	0.9822	3.0853	3.6528	1.8532	1.5961	1.3833	2.4823	1.4831	1.9966
Skewness	-0.2098	0.1552	0.7957	-1.4354	-0.2766	-0.1975	-0.1663	0.6489	-0.0538
Kurtosis	4.9247	8.0694	8.6661	31.4391	7.9169	6.6220	5.6828	10.2894	7.0868
Jarque-Bera	315.60	2098.00	2817.14	66451.21	1991.17	1079.68	594.41	4458.65	1359.33
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

For all the series, kurtosis is more than 3 which implies that the series have fat tails and are leptokurtic. The Jarque-Bera test for normality is also rejected for all the series confirming that the series are indeed non-normal.

Conditional Heteroscedasticity

Table III shows the results of ARCH-LM test suggested by Engle (1982). Analysis of the results reveals that all the eight stocks as well as Nifty have ARCH effects. This implies that the variance of the error term for the time series under consideration suffer from heteroscedasticity and evolves over time. Thus, there is need to capture this time varying nature of error variance. For this purpose, ARCH family of models are required.

Table III. Results of ARCH Test

	Lag 4		Lag 8	
Series	ARCH-LM Stat	p.value	ARCH-LM Stat	p.value
NIFTY 50	53.7433	0.0000	109.2202	0.0000
ADANIPOWER	23.8631	0.0001	46.4267	0.0000
JPPOWER	199.1331	0.0000	207.8056	0.0000
NHPC	9.6133	0.0475	10.0741	0.2599
NTPC	15.2914	0.0041	16.9118	0.0310
POWERGRID	25.3554	0.0000	28.9839	0.0003
RPOWER	23.2332	0.0001	34.7195	0.0000
SJVN	25.2902	0.0000	26.0871	0.0010
TATAPOWER	34.7433	0.0000	53.3202	0.0000
Series	statistic	p.value	statistic	p.value
NIFTY 50	53.7433	0.0000	109.2202	0.0000
ADANIPOWER	23.8631	0.0001	46.4267	0.0000
JPPOWER	199.1331	0.0000	207.8056	0.0000
NHPC	9.6133	0.0475	10.0741	0.2599
NTPC	15.2914	0.0041	16.9118	0.0310
POWERGRID	25.3554	0.0000	28.9839	0.0003
RPOWER	23.2332	0.0001	34.7195	0.0000
SJVN	25.2902	0.0000	26.0871	0.0010
TATAPOWER	34.7433	0.0000	53.3202	0.0000
Series	statistic	p.value	statistic	p.value
NIFTY 50	53.7433	0.0000	109.2202	0.0000
ADANIPOWER	23.8631	0.0001	46.4267	0.0000
JPPOWER	199.1331	0.0000	207.8056	0.0000
NHPC	9.6133	0.0475	10.0741	0.2599
NTPC	15.2914	0.0041	16.9118	0.0310
POWERGRID	25.3554	0.0000	28.9839	0.0003

RPOWER	23.2332	0.0001	34.7195	0.0000
SJVN	25.2902	0.0000	26.0871	0.0010
TATAPOWER	34.7433	0.0000	53.3202	0.0000

[Note: Under ARCH-LM test, the null hypothesis is H0: There are no ARCH effects, i.e., no heteroscedasticity]

GARCH (1,1)

Table IV presents the results of GARCH (1,1) model fitted to individual stock/index return series. For each series, three parameters are estimated viz., ω, α, and β. Out of these three parameters, α and β are important. α, also known as coefficient of ARCH term, represents impact of recent news about volatility, and β, also known as coefficient of GARCH term, tells the impact of old news about volatility. An examination of the α(s) and β(s) for the eight stocks reveals that for almost all of the stocks except Powergrid, α is between 0.3 to 0.6. For Reliance Power, NTPC and Adani Power, α is about 0.3. For SJVN and Tatapower, α is about 0.4. And for JP Power and NHPC, α is about 0.6. For Powergrid α is 0.18 which shows for this stock recent news about volatility is more important. Similarly, except for Powergrid, all stocks have βs between 0.91 to 0.96. For all stocks, $\alpha + \beta$ is close to 1 which implies that volatility clustering is quite high. A comparison of the GARCH parameters of individual's stocks with those of Nifty reveals that power sector stocks have similar volatility characteristics as Nifty.

Table IV: Results of GARCH (1,1)

Series	α	β	Persistence ($\alpha + \beta$)
ADANIPOWER	0.0733	0.9186	0.9920
JPPOWER	0.2270	0.6301	0.8571
NHPC	0.0949	0.8322	0.9271
NIFTY 50	0.0492	0.9426	0.9918
NTPC	0.0363	0.9392	0.9755
POWERGRID	0.1420	0.6852	0.8272
RPOWER	0.0291	0.9662	0.9954
SJVN	0.6601	0.3294	0.9895
TATAPOWER	0.0723	0.8990	0.9713

[Note: α is ARCH term; and β is GARCH term]

GJR GARCH (1,1)

In financial time series, it is commonly observed that positive and negative shocks have differential impact on volatility. This differential impact is known as asymmetric influence. Table V presents estimates of the asymmetric term in GJR-GARCH (1,1) fitted to individual stocks and Nifty. For asymmetric effect, γ should be positive and statistically significant. From the table it can be seen that onlyNifty and TATAPOWER have significant and positive γ. The

analysis of GJR-GARCH (1,1) suggests that for most of the stocks asymmetric influences do not exist.

Table V: Results of GJR-GARCH (1,1) and EGARCH (1,1)

	GJR-GARCH		EGARCH	
Series	γ	p-value	γ	p-value
ADANIPOWER	0.002483	0.9001	0.1780	0.0000
JPPOWER	0.012545	0.8276	0.4249	0.0000
NHPC	-0.0162	0.5932	0.2118	0.0000
NIFTY 50	0.105199	0.0000	0.0862	0.0000
NTPC	-0.01177	0.4891	0.1018	0.0000
POWERGRID	0.032459	0.4662	0.2684	0.0000
RPOWER	-0.00984	0.3801	0.0865	0.0000
SJVN	-0.2185	0.2552	0.6707	0.0000
TATAPOWER	0.059907	0.0164	0.1508	0.0002

EGARCH (1,1)

For studying the asymmetric response of volatility exponential GARCH proposed by Nelson (1991) has also been employed. Under EGARCH formulation, asymmetric effect exists if γ is negative and statistically significant. The estimates of the asymmetric term along with the p-values of fitted model are presented in Table V. The table shows that all the 8 stocks and Nifty have positive and significant γ. This result is a bit puzzling as under EGARCH specification, γ should be negative and significant for leverage effect.Positive-significant γ implies that volatility increases when stock price rises.

Table VI: Result of Granger Causality between Returns

Causality	F-statistic	Causality	F-statistic	Causality	F-statistic
ADANIPOWER ->NIFTY 50	1.0431	NIFTY 50 -> NHPC	4.4778*	NIFTY 50 -> RPOWER	7.1374*
JPPOWER ->NIFTY 50	2.2545	ADANIPOWER -> NHPC	1.9472	ADANIPOWER -> RPOWER	2.7068
NHPC ->NIFTY 50	1.0828	JPPOWER -> NHPC	2.4765	JPPOWER -> RPOWER	4.2193*
NTPC ->NIFTY 50	0.8429	NTPC -> NHPC	4.7009*	NHPC -> RPOWER	3.5406*
POWERGRID ->NIFTY 50	0.9136	POWERGRID -> NHPC	7.3367*	NTPC -> RPOWER	4.6471*
RPOWER ->NIFTY 50	3.9713*	RPOWER -> NHPC	2.4476	POWERGRID -> RPOWER	2.3868
SJVN ->NIFTY 50	1.9149	SJVN -> NHPC	0.7701	SJVN -> RPOWER	1.4471
TATAPOWER ->NIFTY	1.6925	TATAPOWER -> NHPC	0.9291	TATAPOWER ->	0.7817

50				RPOWER	
NIFTY 50 -> ADANIPOWER	2.2110	NIFTY 50 -> NTPC	4.9531 *	NIFTY 50 -> SJVN	8.0726 *
JPPOWER -> ADANIPOWER	0.2206	ADANIPOWER -> NTPC	2.4171	ADANIPOWER -> SJVN	4.1446 *
NHPC -> ADANIPOWER	0.2422	JPPOWER -> NTPC	3.4813 *	JPPOWER -> SJVN	4.5345 *
NTPC -> ADANIPOWER	1.9631	NHPC -> NTPC	1.0741	NHPC -> SJVN	6.4727 *
POWERGRID -> ADANIPOWER	2.0768	POWERGRID -> NTPC	0.6500	NTPC -> SJVN	7.9058 *
RPOWER -> ADANIPOWER	0.9476	RPOWER -> NTPC	2.1656	POWERGRID -> SJVN	3.7183 *
SJVN -> ADANIPOWER	1.9668	SJVN -> NTPC	2.0059	RPOWER -> SJVN	7.4618 *
TATAPOWER -> ADANIPOWER	0.2704	TATAPOWER -> NTPC	1.4557	TATAPOWER -> SJVN	2.1237
NIFTY 50 -> JPPOWER	3.0612 *	NIFTY 50 -> POWERGRID	3.7237 *	NIFTY 50 -> TATAPOWER	9.9821 *
ADANIPOWER -> JPPOWER	1.3629	ADANIPOWER -> POWERGRID	0.6677	ADANIPOWER -> TATAPOWER	1.8894
NHPC -> JPPOWER	0.0797	JPPOWER -> POWERGRID	8.2330 *	JPPOWER -> TATAPOWER	0.1755
NTPC -> JPPOWER	0.3057	NHPC -> POWERGRID	2.4686	NHPC -> TATAPOWER	2.2287
POWERGRID -> JPPOWER	2.1316	NTPC -> POWERGRID	7.1208 *	NTPC -> TATAPOWER	2.9962
RPOWER -> JPPOWER	1.1099	RPOWER -> POWERGRID	2.6050	POWERGRID -> TATAPOWER	2.9952
SJVN -> JPPOWER	2.2867	SJVN -> POWERGRID	0.0427	RPOWER -> TATAPOWER	3.5043 *
TATAPOWER -> JPPOWER	0.6633	TATAPOWER -> POWERGRID	2.7163	SJVN -> TATAPOWER	2.1763

[Note: => implies "does not granger cause". * denotes significance at 5% level.]

Table VII: Result of Granger Causality between Variance Series

Causality	F-statistic	Causality	F-statistic	Causality	F-statistic
ADANIPOWER ->NIFTY 50	0.2550	NIFTY 50 -> NHPC	0.0125*	NIFTY 50 -> RPOWER	0.4284*
JPPOWER ->NIFTY 50	0.3776	ADANIPOWER -> NHPC	0.0483	ADANIPOWER -> RPOWER	2.6061
NHPC ->NIFTY 50	0.0717	JPPOWER -> NHPC	2.6844	JPPOWER -> RPOWER	2.2761*
NTPC ->NIFTY 50	0.2747	NTPC -> NHPC	0.1659*	NHPC -> RPOWER	0.0908*
POWERGRID ->NIFTY 50	2.2676	POWERGRID -> NHPC	12.4735*	NTPC -> RPOWER	1.0979*
RPOWER ->NIFTY 50	0.8806*	RPOWER -> NHPC	0.1100	POWERGRID -> RPOWER	0.1836
SJVN ->NIFTY 50	0.2119	SJVN -> NHPC	0.7784	SJVN -> RPOWER	2.2657
TATAPOWER ->NIFTY 50	2.3923	TATAPOWER -> NHPC	0.5544	TATAPOWER -> RPOWER	0.5204
NIFTY 50 -> ADANIPOWER	1.1617	NIFTY 50 -> NTPC	3.0177*	NIFTY 50 -> SJVN	0.3779*
JPPOWER -> ADANIPOWER	0.3388	ADANIPOWER -> NTPC	0.3759	ADANIPOWER -> SJVN	5.1781*
NHPC -> ADANIPOWER	0.1477	JPPOWER -> NTPC	0.8964*	JPPOWER -> SJVN	2.7731*
NTPC -> ADANIPOWER	1.5632	NHPC -> NTPC	0.0778	NHPC -> SJVN	0.3938*
POWERGRID -> ADANIPOWER	0.3618	POWERGRID -> NTPC	6.6119	NTPC -> SJVN	0.3384*
RPOWER -> ADANIPOWER	0.1189	RPOWER -> NTPC	0.0319	POWERGRID -> SJVN	0.2634*
SJVN -> ADANIPOWER	13.7846	SJVN -> NTPC	0.1293	RPOWER -> SJVN	2.2843*
TATAPOWER -> ADANIPOWER	1.2556	TATAPOWER -> NTPC	4.0520	TATAPOWER -> SJVN	2.9062
NIFTY 50 -> JPPOWER	1.8732*	NIFTY 50 -> POWERGRID	1.8566*	NIFTY 50 -> TATAPOWER	2.1642*
ADANIPOWER -> JPPOWER	2.7053	ADANIPOWER -> POWERGRID	1.0817	ADANIPOWER -> TATAPOWER	2.8071
NHPC -> JPPOWER	1.6421	JPPOWER -> POWERGRID	7.2186*	JPPOWER -> TATAPOWER	11.0702
NTPC -> JPPOWER	0.5936	NHPC -> POWERGRID	1.8282	NHPC -> TATAPOWER	0.9210
POWERGRID -> JPPOWER	7.2441	NTPC -> POWERGRID	3.5626*	NTPC -> TATAPOWER	2.1346
RPOWER -> JPPOWER	1.0261	RPOWER -> POWERGRID	1.6183	POWERGRID -> TATAPOWER	136.3002
SJVN -> JPPOWER	0.1812	SJVN -> POWERGRID	0.5864	RPOWER -> TATAPOWER	1.1932*
TATAPOWER -> JPPOWER	3.4751	TATAPOWER -> POWERGRID	1.3015	SJVN -> TATAPOWER	25.5439

[Note: => implies "does not granger cause". * denotes significance at 5% level.]

Table VI presents results of Granger causality test between returns for each pair of series. From the table, it can be seen that Granger causality for returns runs from –ADANIPOWER to SJVN; JPPOWER to NTPC, POWERGRID, RPOWER and SJVN; NHPC to RPOWER and SJVN; NIFTY 50 to JPPOWER, NHPC, NTPC, POWERGRID, RPOWER, SJVN and TATAPOWER; NTPC to NHPC, POWERGRID, RPOWER and SJVN; POWERGRID to NHPC and SJVN; and RPOWER to NIFTY 50, SJVN and TATAPOWER

Table VII presents results of Granger causality test between conditional variances for each pair of series. The conditional variance series for each stock/index is obtained from GARCH (1,1) fitted to return series. From the table, it can be seen that Granger causality for variance runs from–ADANIPOWER to SJVN; JPPOWER to POWERGRID and TATAPOWER; NIFTY 50 to NTPC; NTPC to POWERGRID; POWERGRID to JPPOWER, NHPC, NTPC and TATAPOWER; SJVN to ADANIPOWER and TATAPOWER; and TATAPOWER to JPPOWER and NTPC.

Conclusion

The present study is an attempt to characterize the nature of return and volatility dynamics in the selected power sector stocks. The study has used daily closing prices data for the period from January 04, 2011 to December 31, 2018. All the stocks show the stylized facts of fat tails, volatility clustering and volatility persistence. GARCH model suggests the nature of conditional volatility is similar among stocks. GJR-GARCH suggests that asymmetric response is present only in Nifty 50 and TATAPOWER. On the other hand, EGARCH reveals that all stocks have asymmetric response of volatility. However, the positive significant asymmetric term, γ, in EGARCH is puzzling. It is because in most cases volatility rises when stock prices decline and positive significant γ means that volatility rises more when prices rise as compared to when prices decline. Granger causality based on bivariate VAR suggests that past returns of Nifty 50 are helpful for forecasting returns of all stocks except DANIPOWER. Further, Granger causality on conditional variance series indicates that past conditional variance of POWERGRID influences most of the stocks.Understanding returns and volatility structure is important for arbitrageurs, speculators and hedgers. The knowledge about volatility dynamics of any asset can help in making better investment decisions.

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Integrating Linkages between Training Program and Employee Performance: An Exploratory Study at Mumbai

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Abstract

To maintain cost-effective with effectual performance, it is imperative to construct the finest contribution of manpower to accomplish the purpose of the organization. The worth of manpower is a fundamental success for an organization. Today, employees are vital, but an exclusive resource and that can be achieved through proper instructional guidance. The assessment of training programs will be accepted through logical consideration of its immediate influence on employee performance. Employee progressions lead the way to overall perfection in organizational productivity. This paper is an effort to survey its worth and its influence on the workforce. To make the workforce more capable of doing the existing job and to prepare them for higher rank responsibilities, the training program is considered one of the mechanisms that will improve skills. This topic is an exploration of the linkages between the training program and employee performance. A structured questionnaire has been designed for the primary data and convenience sampling methods were used. Statistical techniques such as SPSS used to obtain the result of the analysis. The sample size was 100. The findings illustrate that all independent variables encompass a substantial effect on employee performance. Further, limitation and scope for future work have also been discussed in the study.

Keywords: Training Program, Human resource, Organizational Productivity, IT Industry, Employee Performance.

Introduction

In present scenario, diversified labor force witnesses its developing work demand and its changing expertise are entirely different from other industries. In Indian, IT sector, it requires focused strategies and policies to create corporate culture for achieving organizational excellence. Human supply is the foremost resource of the organization. It is considered the backbone of every organization. It is a vital asset that multiplies the functioning of the business. As a result, the organization is now spending a massive amount on human capital. It has been observed that organizational sustainable development will be enhanced by employee development

The IT industry in India is now developing at a fast pace and is coming up with major players. With the advent of innovative technologies like SAP, the need for effective training and development has increased. The IT industry invigorates economic development by energizing advanced edification and transforming India's image worldwide. By providing work to 10 million Indians, IT Industry has contributed a lot to social transformation of the country (IBEF Report, 2014). India has prospective to develop a US$ 100 billion software product industry by 2025 (iSPIRT,2018).

To perform job efficiently, it has been analyzed that training is a form of interest that is designed, structured and results into superior level of expertise, learning and proficiency that is required nowadays (Gordon 1992). On the other hand, Development aimed at bringing organization in the lead to another threshold of performance which is considered as broad ongoing multifaceted set of activities that often perform innovative task in the future (McNamara, 2008).

Rama V. and Nagurvalu Shaik (2012) state that knowledge, competence, and abilities are influential features of employee performance which highlight that continuous investment by an organization will improve their employee's productivity. To enhance employee's productivity, organization instructs and builds their workforce to the fullest that encourage unraveling the prospective progression and advancement prospect.

It is believed that manpower is the utmost asset for every organization; their worth can be improved by putting in proper time and money in their advancement. To do this, training programs are indispensable that focuses on boosting morale of employees and organizations output as well.

Literature Review:

Cole (2002) states that training is an activity that aimed towards the attainment of particular goal. The important aspect of training is the accomplishment of the task.

McGhee (1996) elicits that official guidance is an opportunity for the staff provided by the employer to attain job related skills and tactics. A structured and systematic effort by management will always premeditated that will assist to achieve organizational goals.

Training is a tool that supports a corporation to accomplish its purpose. However, job interviewees are carefully examined but more often a disparity remains between employees' present expertise and enhanced intelligence. Therefore, it is become a necessity for organizations to prepare human resource strategically with requisite skills (Krietner, 1995)

Harrison (2009) state that the potential of individual will be considered as primary goal of knowledge and advancement process which can be achieved with the help of experts through collective process, moral inspiration and assistance of knowledge and expertise that encourage business to achievetarget.

Ramya (2016) elicits in her paper that there is previous shred of evidence which highlights the positive outcome between HRM system and managerial execution. In contrast, Falola et.al (2014) states that training is a requisite tool which helps employees to cope up with the actual

work environment. Nowadays, organization keep increasing budget with a view to gain competitiveedge.

Beardwell et al. (2004) elicits that training program need extensive and incessant investment to improve upon. It has been observed that success mostly depends on aptitude and competence of their employees and this could be the reason that technical and organizational restructuring led many employers to acknowledge these facts.Shonhiwa (2018) elicits that training is one of the effective instrument for any organization. Consequently, HR is more responsible to provide necessary logistics to the trainer as well as trainees. It is responsibility of trainer to engage its listeners throughout training period, because the trainer's experience has the potential to influence the training attributes.

Training plays a crucial task in increasing organizational productivity and improving the functioning of employees. Therefore, it has been concluded that affirmative affiliation lead towards training and performance of the workforce. It is generating benefits to both organizations as well as employees (Benedicta and Appiah, 2010)

Lindsay (1999) states regarding 40 hours of training were provided by Motorola and Texas Instruments to their employees quarterly and this has drastically affected on productivity. On the other hand, Noe et.al, (2000) explains that it is bemoaned that the deficiency of training by employers in US, when they stated that statistics suggests that US employees i.e. 16% who have never received any training from theiremployees.

Jehanzeb and Beshir (2013) state that training is a central role in every organization. Hence, to sustain effective performance, an organization should optimize the contribution of employees. It is rightly said that one contribution of management will lead to other's vision and ability toperform.Colarelli and Montei (1996) state that with the advancement in technology, companies are realizing real worth of training. Previous studies gave a substantiation concerning the constructive outcome of training guidance not only on employees but also on organizational productivity. In contrast, earlier studies evident that operative training programs leads to improved returns on investment whereas former practitioners indicated optimistic function of training to accomplish ultimate level of employee retention.

Armstrong (2012) state that to attain prerequisite skills and to impart knowledge, training is considered as systematic application of formal processes which help employees to function their job adequately. Landy and Conte (2007) put forward that the foundation of training programs is knowledge, a relatively eternal modification in human actions and competencies that are created by learning exercise. Herman and Kurt (2009) elicited that development, in contrast, is a systematic attempt that affects knowledge or skills of an individual with an intention of personal growth or future jobs roles.

Wan (2007) argues that with comprehensive training and career development, organization can improve workforce productivity. To achieve this purpose in this rapidly changing and complex work environment, an organization needs to devote into their employees to obtain the required skills and qualities that will facilitate them to performefficiently.

Objectives of Research:

- To identify the linkages between the training program and employee performance in the IT industry at Mumbai.
- To recommend a feasible solution for implementing an effective training program for employees.

Research Design and Methodology:

The following is the framework (plan and structure) of the study that provides specific details regarding the processes followed in conducting the research:

Population	The employees from IT Industry in Mumbai
Data Collection	Primary Data: Questionnaire Secondary Data: EBSCO, Web Sources, Google Scholar, Journals, Magazines, Books and Articles
Scale	Likert Scale – 5 Point (Strongly Disagree -1, Disagree - 2, Neutral - 3, Agree - 4, Strongly Agree - 5).
Size of Sample	100 Employees
Method of Sampling	Convenience Sampling
Measurement Techniques	The proposed study shall include descriptive and inferential statistics such as Correlation and Regression Analysis
Statistical Tool for Analysis	A SPSS software package will be used to obtain the results of the analysis throughout the study.

Conceptual Framework:
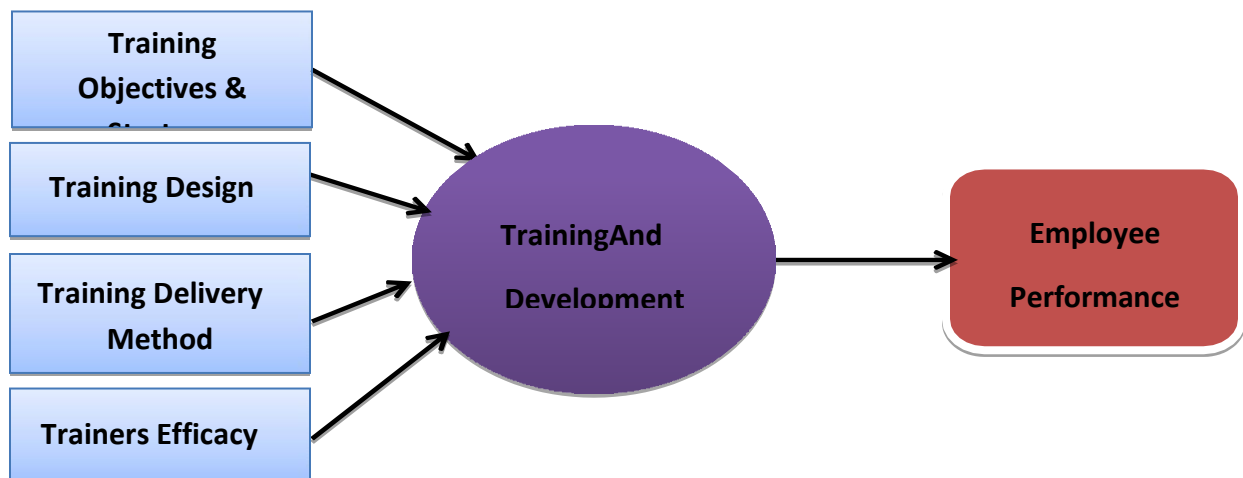
From the above framework, it elucidate that to study the independent variable (IV)) and dependent variable (DV) various elements such as training objectives and strategy, training design, training delivery method and effectiveness of trainers are also recognized due to which the association linking the two isconsidered.

Hypothesis:

The following five hypotheses were put forth:

Ha	There is a significant linkage between training objectives and strategy on employee performance.
Hb	Training design has a positive impact on employee performance.
Hc	Training delivery method has a significant effect on employee performance.
Hd	There is a significant linkage between the trainer's effectiveness and employee performance.
He	There is a significant linkage between the training program and employee performance.

Result Analysis and Interpretations:

Respondents of the study are existing subordinate level managers and senior executives at higher level in selected IT companies. The sample unit consists of existing managerial level employees who have attended at least one training program during last 3 financial years. The size of sample for survey is 100 employees from different IT industry in Mumbai. The demographics are irrespective of the age, gender, qualification and work experience of the employees.

A) Descriptive Analysis:

1. Training program helps me to be updated with innovative processes related tojob.
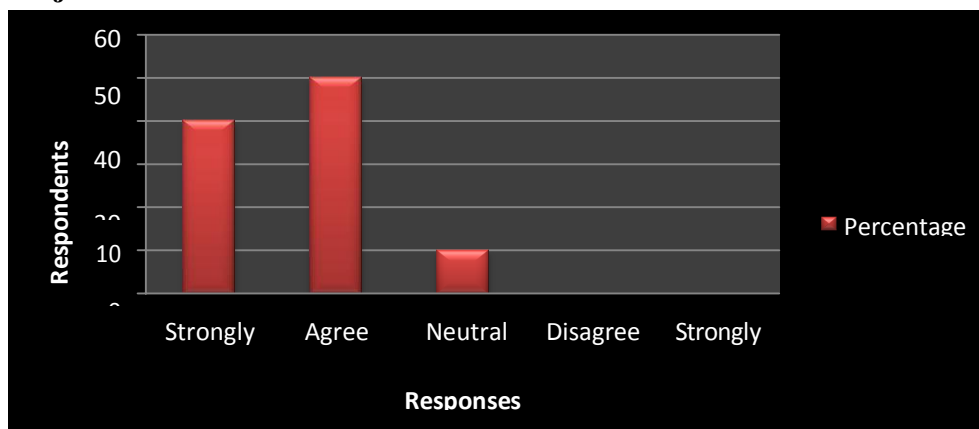
The above chart depicts that 50% of workforce says that the training programs are aligned with the new processes related to their job. 10% of the respondents yet are neutral on their comments. Therefore, training programs must be related to the recent market trends and processes.

2. The training programme was appropriate to my developmentalneeds.
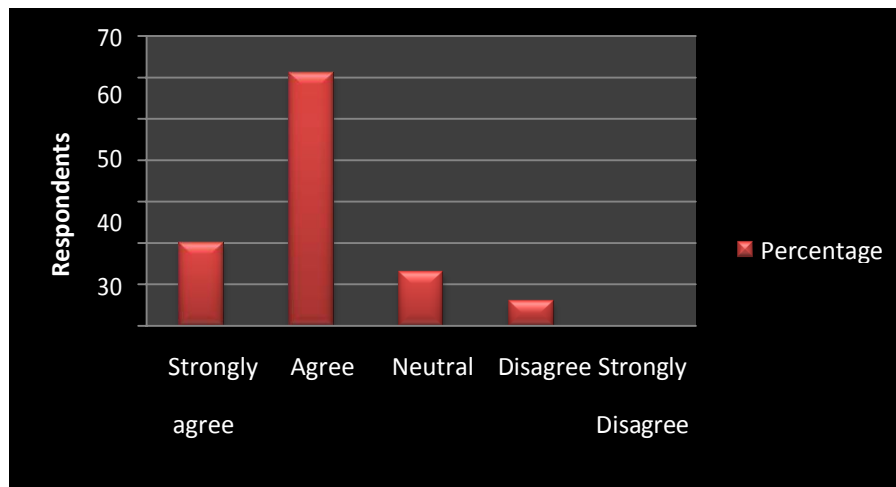
The above chart implies that 61% of the workforce experience that the training programs were relevant as per their needs. However, 13% of the population was neutral to the question and 6% think that were not relevant to their needs. Therefore, IT companies make sure that they should design training programs which satisfies developmental needs of thetrainees.

3. According to program objective, the design of the training module wasappropriate.
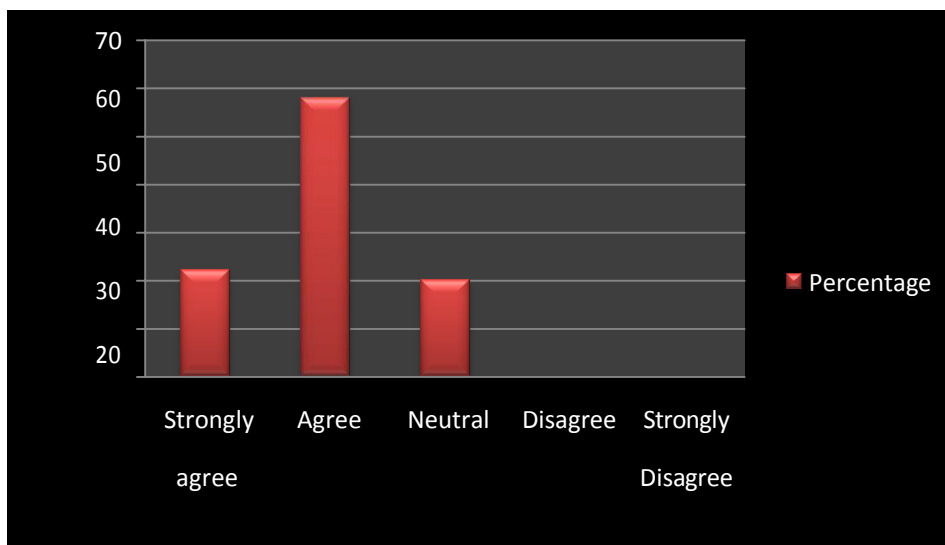
The above analysis interpreted that 59% of the employee's experience that the overall design of the training programmes were relevant to their objectives. This implies that the IT companies are more aware about their employee's needs and expectations. However, 20% of the respondents are neutral about their comments.

4. During training, various training methods were used effectively for understanding thesubject.
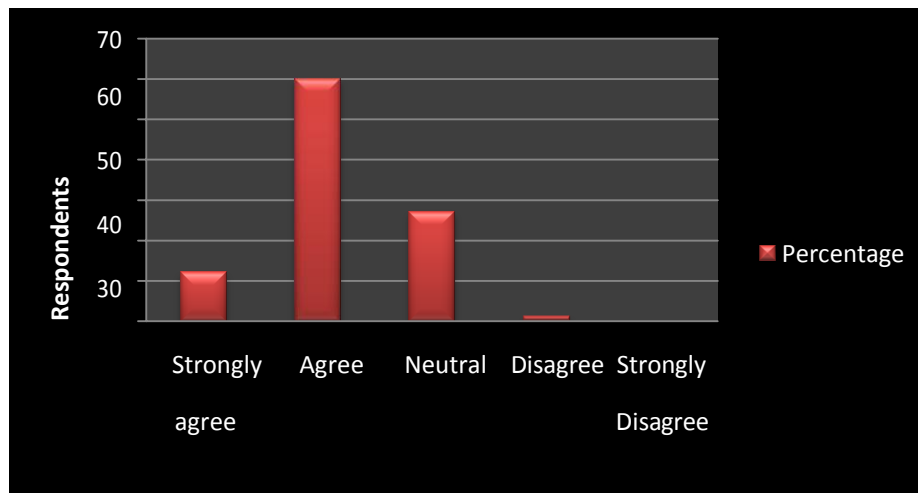
In this case, 60% employees consider methods of training which were used during the programmes were not only effective but also helpful in understanding the subject, yet 27% of the respondents were neutral. Therefore, IT organizations should use advanced technology to boost the training program effectiveness.

5. The trainers had good command on the subjectmatter.
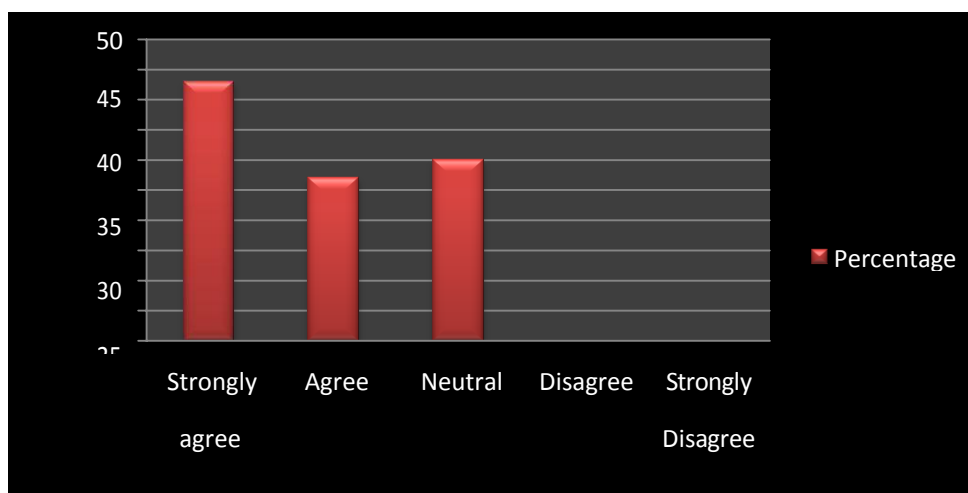
From the above chart, it is interpreted that 42% of the workforce replied that the trainers had good command on the subject matter of the training programs. However, 30% of the respondents

are neutral to this statement. Hence, the IT companies should appoint trainers who are well-versed in their knowledge and effective in terms of the subject expertise and relevant experience.

6. The trainers were able to deliver the programeffectively.
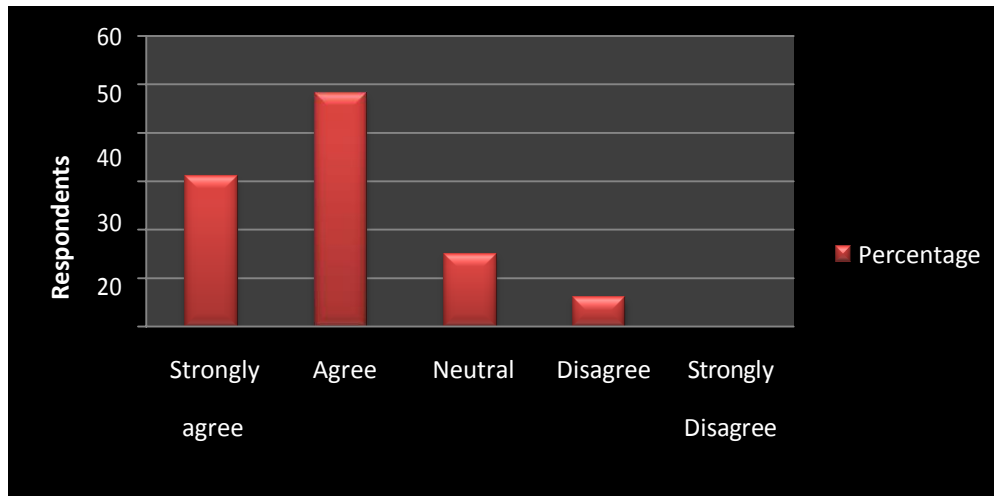
The above chart explains that 49% of the workforce agrees to the fact that the trainers were able to deliver the training programs effectively. Yet, 15% of the respondents are neutral to this statement and 6% of the workforce disagrees with this statement. Therefore, the trainers should take pre-training feedback of the respondents regarding their expectations from the training program and deliver the training accordingly.

7. I believe that skilled employees recognize the complex issues and develop the solutions quickly.
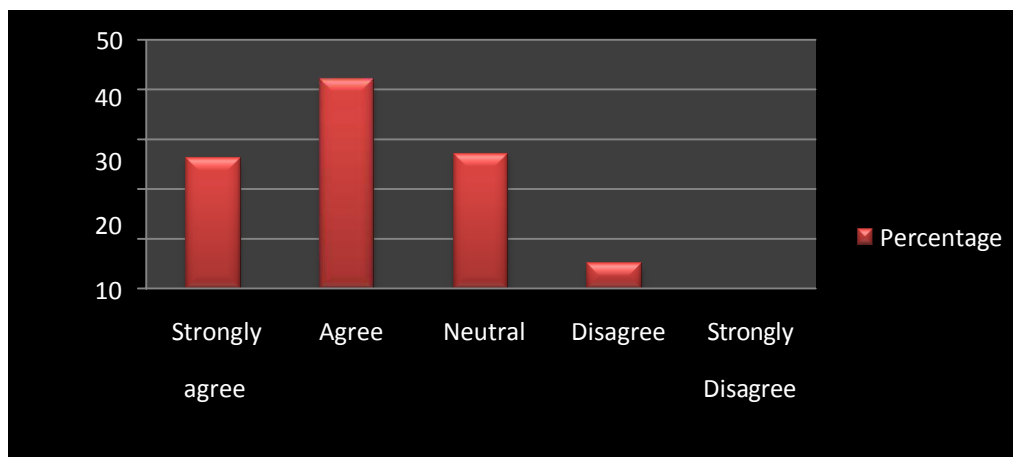
As per above chart analysis, it can be interpreted that 42% of the respondents believe that skilled employees recognize the complex issues and resolve it quickly. However, 27% of the respondents are neutral to this statement and 5% of the workforce disagrees to this statement. Therefore, IT organizations should conduct training programs that can multiply the competence of the workforce and they can develop problem-solving skills.

8. Training provided has increased myefficiency.
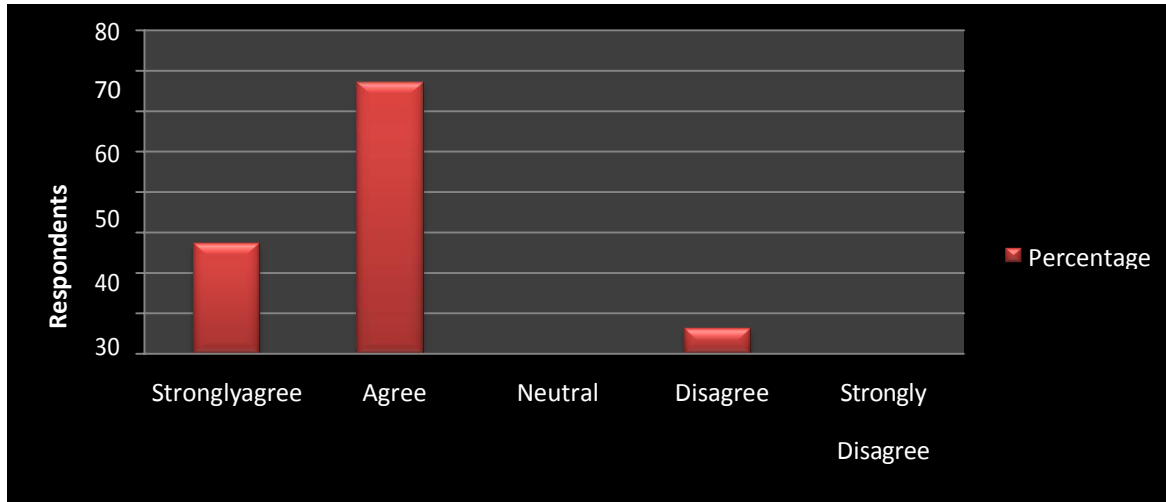
From the above graph, it can be interpreted that 68% of the employees feel that the training provided to them has increased their on the job efficiency but 6% of the respondents disagree to this statement. Therefore, IT organizations must include more innovative and recent matter in their training activities which will help employees to increase their on the job efficiency.

B. nferentialAnalysis:

The inferential analysis of the data is done as follows:

Table 1: Analysis of Mean, Standard Deviation and Item Reliability:

Variables	N	Min	Max	Mean	Standard Deviation	Sample Variance
Training and Development	100	2.92	4.75	3.87	0.36	0.13
Training Objectives	100	2.25	4.75	3.84	0.50	0.25
Training Delivery	100	3.06	4.75	3.93	0.35	0.13
Training Design	100	3.10	4.83	3.94	0.36	0.13
Trainers Efficacy	100	3.08	4.79	3.94	0.36	0.13
Employee Performance	100	3.25	5	4.07	0.42	0.18

From the above descriptive analysis, it can be interpreted that all the variables in this study have < 1.

C. Pearson - CorrelationAnalysis:

Table 2: Estimated Results

	Training Program	Training Objectives	Training Delivery	Training Design	Trainers Efficacy	Employee Performance
Training and Development	1					
Training Objectives	0.82	1				
Training Delivery	0.94	0.97	1			
Training Design	0.88	0.99	0.99	1		
TrainersEfficacy	0.91	0.98	0.99	0.99	1	
Employee Performance	0.55	0.28	0.41	0.34	0.38	1

** Correlation is significant at the 0.01 level (2-tailed)

It was found from the above analysis that the coefficient of correlation between training and employee performance is 0.55 at significance level of 0.01 (2-tailed).

D. Regression Analysis:

The regression analysis is performed and results explained in the table below.

Table 3: Estimated Result

List of Variables	Constant	Coefficient	R²	T	P-Value	F
Training Objectives and Performance	3.17	0.23	0.08	2.88	0.004	8.28
Training Design and Performance	0.67	0.86	0.56	11.06	6.12809E-19	122.35
Training Delivery and Performance	0.77	0.84	0.51	10.02	1.11887E-16	100.31
Trainer's Efficacy and Performance	0.71	0.85	0.53	10.56	7.43817E-18	111.49
Training Program andPerformance	1.56	0.65	0.31	6.56	2.51561E-09	43.07

From the above results, it is interpreted a strong linkage between training program and employee performance.

Ha: Training Objectives and strategy has a significant linkage between employee performance.

R^2	0.08
T - value	2.88
F-test	8.28 (Model's strength)
P - value	0.004

From the above findings, it indicates that training objective is a controlled variable of its response variable. Therefore, alternative hypothesis accepted.

Hb: Training design has a positive impact on Employee Performance.

From above analysis, it is interpreted that training design has a positive effect on employee performance because $p < 0.01$.

R^2	0.56
T - value	11.06
F-test	122.35 (Model's strength)

Hc: Training delivery method has a significant effect on employee performance.

R^2	0.51
T-value	10.02
F-test	100.31 (Model's strength)

From the above table, it indicates that training delivery as good predictor for its outcome variable which results into significant relationship between two variables. Therefore, alternative hypothesis is accepted.

Hd: There is a significant linkage between the trainer's efficacy and employee Performance.

R^2	0.56
T-value	10.56
F-test	111.49 (Model's strength)

From the above analysis, the results are significant in fourth hypothesis and the null hypothesis is not accepted.

He: There is a significant linkage between training program and employee performance.
The results exemplify constant value i.e. 1.56 which emphasizes on training and development is 0, 1.56 will be employee performance. Co-efficient value in the regression table is 0.65 that indicates 1% raise in training program makes 65% increase in employee performance.

P <indicates that relationship issignificant.

T-value	6.56
F-test	43.07 (Model's strength)

Study Findings and Discussions:
From the above analysis of correlation and regression results, it is examined that for each elements of training program are positively related with the performance of employees. Furthermore, regression model is a strong model in case of all hypothesis and the co-efficient and constant values are positive and significant.

From the descriptive analysis, it is inferred that the results of the above data are positive. The respondents had a positive view regarding the statements related to these elements. Also, the respondents had positive responses to their performance post-training programs.

The major findings explore that training and development are incorporated into organization culture of IT companies. It can be seen that the employees are kept up to date with the recent trends and processes through relevant training. The training aids and methods used were effective as per the program objective. The respondents believed that the trainers had adequate knowledge and command over the subject. However, some of the respondents were neutral about the delivery style of the trainers. The respondents observed that contents of the training modules were relevant to program objectives. However, some of the respondents suggested that the overall design of the program would have been more effective as per their needs. The respondents have agreed to the fact that they are able to relocate their knowledge through training atwork.

On the origin of these results, some of the major recommendations to the IT organizations
- Training need analysis is an important element that can help to achieve desired targets of anorganization.
- Training needs should be aligned with company objectives. As per the staff requirement, training should beorganized.
- Training is always considered a critical part of the organizational structure. In this cutthroat competition, organization should invest in employee training which

demands the enhancement not only skills but also the expertiseknowledge.

- The training programs can also be organized as per department wise in order to give focused attention towards the functionalcompetencies.
- The IT companies should have a systematic, structured and transparent performance management system with the latest technology available in the market which inculcates performance oriented culture in theorganization.
- Succession planning is basically an enhancement of skills for leadership position that can be achieved by proper career planning and instructional training bytrainer.

Conclusion:

From the above findings and discussions, it is concluded that the foundation of the study is focuses not only on planned design and systematic implementation but also tailored towards enhanced employee performance and productivity. Training is measured mechanism that helps in overcoming imperfection in human performance at work. Training enhances not only aptitude, capability but also in the long run improves the output in organizations. Organization have recognized the worth of training and in full swing putting in huge amount that will help to attain both short and long term benefits. Organizational success depends not only on their employee skills but also depends on continuous investment in training. Training is a need for today's generation for smooth functioning ofbusiness.

In a nutshell, the study concluded that training program is an operative instrument which can be employing by any organization and hence, right type of investment in employee training can boost not only individual performance but organization performance as well.

Study Limitations:

The above study is empirical in nature. The sample size was restricted to 100 employees and therefore the outcomes may have a degree of dissimilarity. The information given by the respondents was unenthusiastic. It was time constraint as employees seemed to have a lack of timing to fill up the responses.

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Returns and Volatility Dynamics of Select Indian Power Sector Stocks

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ABSTRACT

The present study is an attempt to characterize the nature of return and volatility dynamics in the selected power sector stocks. The study has used daily closing prices data for the period from January 04, 2011 to December 31, 2018. All the stocks show the stylized facts of fat tails, volatility clustering and volatility persistence. GARCH model suggests the nature of conditional volatility is similar among stocks. GJR-GARCH suggests that asymmetric response is present only in Nifty 50 and TATAPOWER. On the other hand, EGARCH reveals that all stocks have asymmetric response of volatility. However, the positive significant asymmetric term, γ, in EGARCH is puzzling. It is because in most cases volatility rises when stock prices decline and positive significant γ means that volatility rises more when prices rise as compared to when prices decline. Granger causality based on bivariate VAR suggests that past returns of Nifty 50 are helpful for forecasting returns of all stocks except DANIPOWER. Further, Granger causality on conditional variance series indicates that past conditional variance of POWERGRID influences most of the stocks. Understanding returns and volatility structure is important for arbitrageurs, speculators and hedgers. The knowledge about volatility dynamics of any asset can help in making better investment decisions.

Keywords: Power sector, Volatility Spillover, Granger Causality.

Introduction

Stock market is called barometer of economy. The health of any economy can be gauged by the functioning of its stock market. If economy is doing well, then stock prices rise and during bad times stock prices decline. Besides, stock prices fluctuate violently during times of uncertainty. From announcement of dividend to change in management, everything has a bearing on the stock prices. Stock prices are directly affected by the growth of the economy which in turn depends on the growth of the infrastructure sector.Power or electricity is an essential component of the infrastructure sector of an economy. It is one of the key inputs which affect the growth of a country. According to the 2017-18 report of the Central Electricity Regulatory Commission (CERC), the installed power generation capacity in India witnessed a compounded annual growth rate (CAGR) of 10 per cent during the period 2008-09 to 2017-18. During the same period, the CAGR in gross power generation was 6 per cent. As Indian economy continues on its

growth trajectory, the infrastructure sector especially the power sector will also grow. Thus, to participate in the growth of the power sector, investors can buy shares of power sector stocks. Towards this end, understanding the risk-return profile of power sector stocks is important. In this backdrop, the present study is an attempt to characterize the returns and volatility characteristics of selected power sector stocks in India.

Data

The present study has used daily closing prices of eight power sector stocks included in Nifty 50 index for the period from January 04, 2011 to December 31, 2018. The data is collected from Yahoo India Finance (https://in.finance.yahoo.com/).
For analysing the data, the study has used the following R packages: aTSA, ggplot2, MSBVAR, quantmod, rugarch and xts

Methodology

As a first step, the time series under consideration are studied for presence of unit roots. If the series has a unit root, then it is called non-stationary series. Since, regression analysis of non-stationary series is spurious, it is necessary to convert the non-stationary series into stationary. For finding out the presence of unit root, the Augmented Dickey Fuller test is used (Dickey and Fuller, 1979). If the series is found to have a unit root, i.e., non-stationary, then first difference is taken to make the series stationary as follows:

$R_t = \ln(P_t) - \ln(P_{t-1})$

where

P_t = price at time t

R_t = continuously compounded return at time t

GARCH Models

The classical regression models assume that error term has constant variance. However, Engle (1982) have shown that assets returns exhibit some stylized characteristics of volatility clustering called autoregressive conditional heteroscedasticity commonly known as ARCH effects. ARCH effect is the tendency of small changes following small changes and large changes following large changes. As a result of this, the variance of the error term is not constant over time. Therefore, the usual OLS cannot be used. Engle (1982) suggested ARCH model to capture this behaviour of stock market returns. Under ARCH/GARCH family of models, two regression equations are used: the mean equation, and the variance equation. The simplest ARCH model is given by:

$R_t = \mu + \varepsilon_t[\varepsilon_t \sim N(0, \sigma_t^2)]$ ... ... Mean Equation

$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2$ ... ... Variance Equation

where

R_t = daily return defined as $R_t = \ln P_t - \ln P_{t-1}$ (P_t is price level at time t)

μ can take any form (generally taken to be constant)

ε_t = error term

ω = constant

Further, for the above ARCH model to be meaningful ω > 0 and $0 \leq \alpha < 1$ (Brooks, 2008).

Before using an ARCH model, it should be tested whether an ARCH model is actually required. For this purpose Engle (1982) has suggested a Lagrange Multiplier test often called as ARCH-LM test. The ARCH-LM is based on the squared residuals from the OLS. Specifically the test uses the following functional form:

$$\varepsilon_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots \ldots \ldots \ldots . + \alpha_p \varepsilon_{t-p}^2 + \nu_t$$

where

ε_t = residual from the first stage regression that is $R_t = \mu + \varepsilon_t$

The test statistic is given by TR^2 and is distributed as $\chi^2(p)$. The null and alternative hypotheses under the ARCH-LM test are as follows:

$H_0: \alpha_1 = \alpha_2 = . \ldots \ldots \ldots = \alpha_p = 0$

$H_1: \alpha_1$ or α_2 or $\ldots \ldots \ldots .$ or $\alpha_p \neq 0$

In other words, the null hypothesis states that there are no ARCH effects, i.e., residuals are homoscedastic. If the null hypothesis is rejected then only an ARCH model is required otherwise simple OLS will be sufficient.

It is often seen that to capture the entire dynamics of volatility clustering one lag is not sufficient and therefore a large number of lags are required. One problem with large number of lags is that the non-negativity condition is likely to be violated. This limitation of ARCH models is overcome by Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model proposed by Bollerslev (1986). In a GARCH model the variance equation is given as:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2$$

The above model is called GARCH (p,q) because it has got p GARCH terms (previous fitted variance, i.e., σ_{t-i}^2) and q ARCH terms, i.e., ε_{t-i}^2. However, GARCH (1,1) is sufficient to capture the entire dynamics of volatility clustering. The GARCH (1,1) is given by:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

The above GARCH model is meaningful if ω > 0, α > 0, β ≥ 0 and α + β < 1.

One problem with GARCH model is that it assumes symmetric response of volatility. Since, only squares are used, hence, positive or negative errors, all become positive. However, it is commonly observed that positive and negative shocks have differential effect on volatility. This differential influence of positive/negative shocks (error) is referred to as asymmetric response of volatility. To capture this asymmetric response of volatility, two models are mostly used.

GJR Model

The GJR model is named after Glosten, Jaganathan and Runkle (1993). Under this formulation the variance equation is as follows:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma\varepsilon_{t-1}^2 I_{t-1}$$

where

$$I_{t-1} = \begin{cases} 1 \text{ if } \varepsilon_{t-1} < 0 \\ 0 \text{ otherwise} \end{cases}$$

The above model is meaningful if $\omega > 0$, $\alpha > 0$, $\beta \geq 0$ and $\alpha + \gamma \geq 0$. Further, for leverage/asymmetric effect to be present γ should be more than 0 and statistically significant.

EGARCH Model

Another formulation of asymmetric GARCH model is proposed by Nelson (1991). The simplest EGARCH (1,1) is given by:

$$\ln(\sigma_t^2) = \omega + \alpha\left[\frac{|\varepsilon_{t-1}^2|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}}\right] + \beta\ln(\sigma_{t-1}^2) + \gamma\frac{\varepsilon_{t-1}^2}{\sqrt{\sigma_{t-1}^2}}$$

One advantage of the EGARCH model is that it does not require imposition of non-negativity conditions because $\ln(\sigma_t^2)$ is modelled. For asymmetries to be present, γ should be negative and statistically significant.

Granger Causality

For understanding the returns and volatility dynamics of the selected stocks, the present study has used Granger causality. Granger (1969) stated that a series X_t is said to cause Y_t if lags of X_t help in better forecasting the present values of Y_t than past values of Y_t alone.

$$Y_t = \phi_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{i=1}^{p} \beta_i X_{t-i} + \epsilon_t$$

$$X_t = \psi_0 + \sum_{i=1}^{p} \gamma_i Y_{t-i} + \sum_{i=1}^{p} \delta_i X_{t-i} + \epsilon_t$$

In the above set of equations, if all β_i are zero, then it means that X_t does not granger cause Y_t. Similarly, if all δ_i are zero, then it implies that Y_t does not granger cause X_t. For understanding the return and volatility dynamics, Y_t and X_t are replaced by returns and volatility series respectively.

Empirical Results

Figures1 and 2 depicts the graphs of the log of closing prices and returns respectively of the selected 8 power sector stocks and Nifty 50 for the period Jan 04, 2011 to Dec 31, 2018. From the figures it can be witnessed that the log prices (level series) are non-stationary while returns

(first difference series) are stationary. The statement that the series under consideration are stationary/non-stationary is examined by conducting a formal test i.e. Augmented Dickey Fuller Test. The null hypothesis for ADF test is that the data has unit root or the data is non-stationary.

Figure 1: Time plot of log of closing prices

Figure 2: Time plot of daily log returns (first difference of closing prices)

Table I presents the results of ADF test. An examination of the table I suggest that all the series in their level are non-stationary because the ADF test statistic is less than the critical value in absolute terms at 1% level of significance. Therefore, the hypothesis of non-stationarity (unit root) cannot be rejected. Similarly, on the basis of ADF test results presented in table I for returns, it can be concluded that for all the series returns (first difference series) are stationary.

Table I. Results of ADF Test for Unit Root

Stock	Test stat for levels	Test stat for first difference
NIFTY 50	-0.4320	-30.5018
ADANIPOWER	-2.5888	-29.0442
JPPOWER	-0.7812	-30.0878
NHPC	-2.4957	-30.7384
NTPC	-3.4908	-31.7852
POWERGRID	-0.9883	-32.3037
RPOWER	-1.7536	-29.0302
SJVN	-1.6622	-31.6466
TATAPOWER	-3.1738	-32.7744

[Note. 1% critical value for ADF test is 3.43.]

Table II presents the descriptive statistics for the individual stocks and Nifty 50. As is generally expected, daily % return for almost all the series is close to zero. An examination of minimum and maximum values together with standard deviation reveals that all the 8 stocks are more volatile than Nifty. Among the stocks, JP Power is most volatile because its standard deviation is highest. Skewness for ADANIPOWER, JPPOWER and SJVN is positive and negative for NHPC, NTPC, POWERGRID, RPOWER and TATAPOWER. As is known that the skewness and kurtosis for a standard normal distribution are 0 and 3 respectively, the series under consideration seem different from the normal distribution.

Table II: Descriptive Statistics

	NIFTY 50	ADANIPOWER	JPPOWER	NHPC	NTPC	POWERGRID	RPOWER	SJVN	TATAPOWER
Observations	1952	1952	1952	1952	1952	1952	1952	1952	1952
Mean	0.0291	-0.0480	-0.1691	-0.0056	-0.0147	0.0360	-0.0878	0.0052	-0.0280
Median	0.0394	0.0000	-0.1467	0.0000	-0.0296	0.0249	0.0000	0.0000	-0.0952
Maximum	3.7380	22.5229	25.6462	12.8028	10.1090	6.9721	12.3406	12.6659	11.8911
Minimum	-6.0973	-19.7643	-17.1610	-27.6166	-12.4886	-11.8573	-14.1335	-6.8993	-16.2519
Std. Dev.	0.9822	3.0853	3.6528	1.8532	1.5961	1.3833	2.4823	1.4831	1.9966
Skewness	-0.2098	0.1552	0.7957	-1.4354	-0.2766	-0.1975	-0.1663	0.6489	-0.0538
Kurtosis	4.9247	8.0694	8.6661	31.4391	7.9169	6.6220	5.6828	10.2894	7.0868
Jarque-Bera	315.60	2098.00	2817.14	66451.21	1991.17	1079.68	594.41	4458.65	1359.33
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

For all the series, kurtosis is more than 3 which implies that the series have fat tails and are leptokurtic. The Jarque-Bera test for normality is also rejected for all the series confirming that the series are indeed non-normal.

Conditional Heteroscedasticity

Table III shows the results of ARCH-LM test suggested by Engle (1982). Analysis of the results reveals that all the eight stocks as well as Nifty have ARCH effects. This implies that the variance of the error term for the time series under consideration suffer from heteroscedasticity and evolves over time. Thus, there is need to capture this time varying nature of error variance. For this purpose, ARCH family of models are required.

Table III. Results of ARCH Test

	Lag 4		Lag 8	
Series	ARCH-LM Stat	p.value	ARCH-LM Stat	p.value
NIFTY 50	53.7433	0.0000	109.2202	0.0000
ADANIPOWER	23.8631	0.0001	46.4267	0.0000
JPPOWER	199.1331	0.0000	207.8056	0.0000
NHPC	9.6133	0.0475	10.0741	0.2599
NTPC	15.2914	0.0041	16.9118	0.0310
POWERGRID	25.3554	0.0000	28.9839	0.0003
RPOWER	23.2332	0.0001	34.7195	0.0000
SJVN	25.2902	0.0000	26.0871	0.0010
TATAPOWER	34.7433	0.0000	53.3202	0.0000
Series	statistic	p.value	statistic	p.value
NIFTY 50	53.7433	0.0000	109.2202	0.0000
ADANIPOWER	23.8631	0.0001	46.4267	0.0000
JPPOWER	199.1331	0.0000	207.8056	0.0000
NHPC	9.6133	0.0475	10.0741	0.2599
NTPC	15.2914	0.0041	16.9118	0.0310
POWERGRID	25.3554	0.0000	28.9839	0.0003
RPOWER	23.2332	0.0001	34.7195	0.0000
SJVN	25.2902	0.0000	26.0871	0.0010
TATAPOWER	34.7433	0.0000	53.3202	0.0000
Series	statistic	p.value	statistic	p.value
NIFTY 50	53.7433	0.0000	109.2202	0.0000
ADANIPOWER	23.8631	0.0001	46.4267	0.0000
JPPOWER	199.1331	0.0000	207.8056	0.0000
NHPC	9.6133	0.0475	10.0741	0.2599
NTPC	15.2914	0.0041	16.9118	0.0310
POWERGRID	25.3554	0.0000	28.9839	0.0003
RPOWER	23.2332	0.0001	34.7195	0.0000
SJVN	25.2902	0.0000	26.0871	0.0010
TATAPOWER	34.7433	0.0000	53.3202	0.0000

[Note: Under ARCH-LM test, the null hypothesis is H0: There are no ARCH effects, i.e., no heteroscedasticity]

GARCH (1,1)

Table IV presents the results of GARCH (1,1) model fitted to individual stock/index return series. For each series, three parameters are estimated viz., ω, α, and β. Out of these three parameters, α and β are important. α, also known as coefficient of ARCH term, represents impact of recent news about volatility, and β, also known as coefficient of GARCH term, tells the impact of old news about volatility. An examination of the α(s) and β(s) for the eight stocks reveals that for almost all of the stocks except Powergrid, α is between 0.3 to 0.6. For Reliance Power, NTPC and Adani Power, α is about 0.3. For SJVN and Tatapower, α is about 0.4. And for JP Power and NHPC, α is about 0.6. For Powergrid α is 0.18 which shows for this stock recent news about volatility is more important. Similarly, except for Powergrid, all stocks have βs between 0.91 to 0.96. For all stocks, $\alpha + \beta$ is close to 1 which implies that volatility clustering is quite high. A comparison of the GARCH parameters of individual's stocks with those of Nifty reveals that power sector stocks have similar volatility characteristics as Nifty.

Table IV: Results of GARCH (1,1)

Series	α	β	Persistence ($\alpha + \beta$)
ADANIPOWER	0.0733	0.9186	0.9920
JPPOWER	0.2270	0.6301	0.8571
NHPC	0.0949	0.8322	0.9271
NIFTY 50	0.0492	0.9426	0.9918
NTPC	0.0363	0.9392	0.9755
POWERGRID	0.1420	0.6852	0.8272
RPOWER	0.0291	0.9662	0.9954
SJVN	0.6601	0.3294	0.9895
TATAPOWER	0.0723	0.8990	0.9713

[Note: α is ARCH term; and β is GARCH term]

GJR GARCH (1,1)

In financial time series, it is commonly observed that positive and negative shocks have differential impact on volatility. This differential impact is known as asymmetric influence. Table V presents estimates of the asymmetric term in GJR-GARCH (1,1) fitted to individual stocks and Nifty. For asymmetric effect, γ should be positive and statistically significant. From the table it can be seen that onlyNifty and TATAPOWER have significant and positive γ. The analysis of GJR-GARCH (1,1) suggests that for most of the stocks asymmetric influences do not exist.

Table V: Results of GJR-GARCH (1,1) and EGARCH (1,1)

Series	GJR-GARCH		EGARCH	
	γ	p-value	γ	p-value
ADANIPOWER	0.002483	0.9001	0.1780	0.0000
JPPOWER	0.012545	0.8276	0.4249	0.0000
NHPC	-0.0162	0.5932	0.2118	0.0000
NIFTY 50	0.105199	0.0000	0.0862	0.0000
NTPC	-0.01177	0.4891	0.1018	0.0000
POWERGRID	0.032459	0.4662	0.2684	0.0000
RPOWER	-0.00984	0.3801	0.0865	0.0000
SJVN	-0.2185	0.2552	0.6707	0.0000
TATAPOWER	0.059907	0.0164	0.1508	0.0002

EGARCH (1,1)

For studying the asymmetric response of volatility exponential GARCH proposed by Nelson (1991) has also been employed. Under EGARCH formulation, asymmetric effect exists if γ is negative and statistically significant. The estimates of the asymmetric term along with the p-values of fitted model are presented in Table V. The table shows that all the 8 stocks and Nifty have positive and significant γ. This result is a bit puzzling as under EGARCH specification, γ should be negative and significant for leverage effect. Positive-significant γ implies that volatility increases when stock price rises.

Table VI: Result of Granger Causality between Returns

Causality	F-statistic	Causality	F-statistic	Causality	F-statistic
ADANIPOWER ->NIFTY 50	1.0431	NIFTY 50 -> NHPC	4.4778 *	NIFTY 50 -> RPOWER	7.1374 *
JPPOWER ->NIFTY 50	2.2545	ADANIPOWER -> NHPC	1.9472	ADANIPOWER -> RPOWER	2.7068
NHPC ->NIFTY 50	1.0828	JPPOWER -> NHPC	2.4765	JPPOWER -> RPOWER	4.2193 *
NTPC ->NIFTY 50	0.8429	NTPC -> NHPC	4.7009 *	NHPC -> RPOWER	3.5406 *
POWERGRID ->NIFTY 50	0.9136	POWERGRID -> NHPC	7.3367 *	NTPC -> RPOWER	4.6471 *
RPOWER ->NIFTY 50	3.9713 *	RPOWER -> NHPC	2.4476	POWERGRID -> RPOWER	2.3868
SJVN ->NIFTY 50	1.9149	SJVN -> NHPC	0.7701	SJVN -> RPOWER	1.4471
TATAPOWER ->NIFTY 50	1.6925	TATAPOWER -> NHPC	0.9291	TATAPOWER -> RPOWER	0.7817
NIFTY 50 ->	2.2110	NIFTY 50 -> NTPC	4.9531	NIFTY 50 -> SJVN	8.0726

ADANIPOWER			*		*
JPPOWER -> ADANIPOWER	0.2206	ADANIPOWER -> NTPC	2.4171	ADANIPOWER -> SJVN	4.1446 *
NHPC -> ADANIPOWER	0.2422	JPPOWER -> NTPC	3.4813 *	JPPOWER -> SJVN	4.5345 *
NTPC -> ADANIPOWER	1.9631	NHPC -> NTPC	1.0741	NHPC -> SJVN	6.4727 *
POWERGRID -> ADANIPOWER	2.0768	POWERGRID -> NTPC	0.6500	NTPC -> SJVN	7.9058 *
RPOWER -> ADANIPOWER	0.9476	RPOWER -> NTPC	2.1656	POWERGRID -> SJVN	3.7183 *
SJVN -> ADANIPOWER	1.9668	SJVN -> NTPC	2.0059	RPOWER -> SJVN	7.4618 *
TATAPOWER -> ADANIPOWER	0.2704	TATAPOWER -> NTPC	1.4557	TATAPOWER -> SJVN	2.1237
NIFTY 50 -> JPPOWER	3.0612 *	NIFTY 50 -> POWERGRID	3.7237 *	NIFTY 50 -> TATAPOWER	9.9821 *
ADANIPOWER -> JPPOWER	1.3629	ADANIPOWER -> POWERGRID	0.6677	ADANIPOWER -> TATAPOWER	1.8894
NHPC -> JPPOWER	0.0797	JPPOWER -> POWERGRID	8.2330 *	JPPOWER -> TATAPOWER	0.1755
NTPC -> JPPOWER	0.3057	NHPC -> POWERGRID	2.4686	NHPC -> TATAPOWER	2.2287
POWERGRID -> JPPOWER	2.1316	NTPC -> POWERGRID	7.1208 *	NTPC -> TATAPOWER	2.9962
RPOWER -> JPPOWER	1.1099	RPOWER -> POWERGRID	2.6050	POWERGRID -> TATAPOWER	2.9952
SJVN -> JPPOWER	2.2867	SJVN -> POWERGRID	0.0427	RPOWER -> TATAPOWER	3.5043 *
TATAPOWER -> JPPOWER	0.6633	TATAPOWER -> POWERGRID	2.7163	SJVN -> TATAPOWER	2.1763

[Note: => implies "does not granger cause". * denotes significance at 5% level.]

Table VII: Result of Granger Causality between Variance Series

Causality	F-statistic	Causality	F-statistic	Causality	F-statistic
ADANIPOWER ->NIFTY 50	0.2550	NIFTY 50 -> NHPC	0.0125*	NIFTY 50 -> RPOWER	0.4284*
JPPOWER ->NIFTY 50	0.3776	ADANIPOWER -> NHPC	0.0483	ADANIPOWER -> RPOWER	2.6061
NHPC ->NIFTY 50	0.0717	JPPOWER -> NHPC	2.6844	JPPOWER -> RPOWER	2.2761*
NTPC ->NIFTY 50	0.2747	NTPC -> NHPC	0.1659*	NHPC -> RPOWER	0.0908*
POWERGRID ->NIFTY 50	2.2676	POWERGRID -> NHPC	12.4735*	NTPC -> RPOWER	1.0979*
RPOWER ->NIFTY 50	0.8806*	RPOWER -> NHPC	0.1100	POWERGRID -> RPOWER	0.1836
SJVN ->NIFTY 50	0.2119	SJVN -> NHPC	0.7784	SJVN -> RPOWER	2.2657
TATAPOWER ->NIFTY 50	2.3923	TATAPOWER -> NHPC	0.5544	TATAPOWER -> RPOWER	0.5204
NIFTY 50 -> ADANIPOWER	1.1617	NIFTY 50 -> NTPC	3.0177*	NIFTY 50 -> SJVN	0.3779*
JPPOWER -> ADANIPOWER	0.3388	ADANIPOWER -> NTPC	0.3759	ADANIPOWER -> SJVN	5.1781*
NHPC -> ADANIPOWER	0.1477	JPPOWER -> NTPC	0.8964*	JPPOWER -> SJVN	2.7731*
NTPC -> ADANIPOWER	1.5632	NHPC -> NTPC	0.0778	NHPC -> SJVN	0.3938*
POWERGRID -> ADANIPOWER	0.3618	POWERGRID -> NTPC	6.6119	NTPC -> SJVN	0.3384*
RPOWER -> ADANIPOWER	0.1189	RPOWER -> NTPC	0.0319	POWERGRID -> SJVN	0.2634*
SJVN -> ADANIPOWER	13.7846	SJVN -> NTPC	0.1293	RPOWER -> SJVN	2.2843*
TATAPOWER -> ADANIPOWER	1.2556	TATAPOWER -> NTPC	4.0520	TATAPOWER -> SJVN	2.9062
NIFTY 50 -> JPPOWER	1.8732*	NIFTY 50 -> POWERGRID	1.8566*	NIFTY 50 -> TATAPOWER	2.1642*
ADANIPOWER -> JPPOWER	2.7053	ADANIPOWER -> POWERGRID	1.0817	ADANIPOWER -> TATAPOWER	2.8071
NHPC -> JPPOWER	1.6421	JPPOWER -> POWERGRID	7.2186*	JPPOWER -> TATAPOWER	11.0702
NTPC -> JPPOWER	0.5936	NHPC -> POWERGRID	1.8282	NHPC -> TATAPOWER	0.9210
POWERGRID -> JPPOWER	7.2441	NTPC -> POWERGRID	3.5626*	NTPC -> TATAPOWER	2.1346
RPOWER -> JPPOWER	1.0261	RPOWER -> POWERGRID	1.6183	POWERGRID -> TATAPOWER	136.3002
SJVN -> JPPOWER	0.1812	SJVN -> POWERGRID	0.5864	RPOWER -> TATAPOWER	1.1932*
TATAPOWER -> JPPOWER	3.4751	TATAPOWER -> POWERGRID	1.3015	SJVN -> TATAPOWER	25.5439

[Note: => implies "does not granger cause". * denotes significance at 5% level.]

Table VI presents results of Granger causality test between returns for each pair of series. From the table, it can be seen that Granger causality for returns runs from –ADANIPOWER to SJVN; JPPOWER to NTPC, POWERGRID, RPOWER and SJVN; NHPC to RPOWER and SJVN; NIFTY 50 to JPPOWER, NHPC, NTPC, POWERGRID, RPOWER, SJVN and TATAPOWER; NTPC to NHPC, POWERGRID, RPOWER and SJVN; POWERGRID to NHPC and SJVN; and RPOWER to NIFTY 50, SJVN and TATAPOWER

Table VII presents results of Granger causality test between conditional variances for each pair of series. The conditional variance series for each stock/index is obtained from GARCH (1,1) fitted to return series. From the table, it can be seen that Granger causality for variance runs from–ADANIPOWER to SJVN; JPPOWER to POWERGRID and TATAPOWER; NIFTY 50 to NTPC; NTPC to POWERGRID; POWERGRID to JPPOWER, NHPC, NTPC and TATAPOWER; SJVN to ADANIPOWER and TATAPOWER; and TATAPOWER to JPPOWER and NTPC.

Conclusion

The present study is an attempt to characterize the nature of return and volatility dynamics in the selected power sector stocks. The study has used daily closing prices data for the period from January 04, 2011 to December 31, 2018. All the stocks show the stylized facts of fat tails, volatility clustering and volatility persistence. GARCH model suggests the nature of conditional volatility is similar among stocks. GJR-GARCH suggests that asymmetric response is present only in Nifty 50 and TATAPOWER. On the other hand, EGARCH reveals that all stocks have asymmetric response of volatility. However, the positive significant asymmetric term, γ, in EGARCH is puzzling. It is because in most cases volatility rises when stock prices decline and positive significant γ means that volatility rises more when prices rise as compared to when prices decline. Granger causality based on bivariate VAR suggests that past returns of Nifty 50 are helpful for forecasting returns of all stocks except DANIPOWER. Further, Granger causality on conditional variance series indicates that past conditional variance of POWERGRID influences most of the stocks.Understanding returns and volatility structure is important for arbitrageurs, speculators and hedgers. The knowledge about volatility dynamics of any asset can help in making better investment decisions.

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Goods and Services Tax – A Global Experience

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Abstract
Goods and Services Tax is a comprehensive value added tax charged on goods and services. It is a destination based tax on consumption of goods and services. As of 2017, out of 193 countries in the world, 160 countries have implemented the indirect tax in the form GST or VAT. So there was no reason for the fastest growing economy in the world to ignore such type tax system and continue with a series of traditional taxes including excise tax, sales tax and service tax. The present research paper is an attempt to study Goods and Services Tax adopted in various countries in the world.
Keywords: GST, VAT, WST, HFE, CGC, OECD

Introduction

Goods and Service Tax is a comprehensive value added tax charged on goods and services. It is a destination based tax on consumption of goods and services. In India, GST has replaced almost all the indirect taxes and has provided a common market for easy tax structure, simple and convenient tax payment.[1] Basically, it is a tax policy which brings uniform market all round the country. It is a destination-based tax on consumption of goods and services. It is proposed to be levied at all the stages right from manufacturer to final consumption with credit of taxes paid at previous stages available as set-off. In short, only value addition is taxed and the burden of tax is to be borne by the final consumer. This system will reduce the complications in the tax structure on the one side and reduce the indirect taxes, import and export taxes also. India has chosen the Canadian model of dual GST.[2]

From a global perspective, India has joined GST bandwagon quite late.[3] After 1954, around 160 nations have introduced GST in their taxation system. However, given the size and scale of India and its federal structure, introducing GST will be regarded as a major financial reform. GST follows principles of value added taxes (VAT) and shifts the focus of the country from a consumption-based tax system to a supply-based tax system. One may regard GST as one of the most debated topics, not only in India but across the world. Globally, the principles of GST follow the best practices and accordingly India has picked up such global best practices and modified it to suit the economic and practical needs of the country. As of 2017, out of 193 countries in the world, 160 countries have implemented the indirect tax in the form GST or VAT. So there was no reason for the fastest growing economy in the world to ignore such type tax system and continue with a series of traditional taxes including excise tax, sales tax and service tax.

GST and Global Scenario

GST has been introduced in many countries several decades ago. At present, about 160 countries have introduced various models of this system except United States. France, Italy, United Kingdom have multiple rates under GST while Singapore taxes everything at a single rate. However, some countries have applied a reduced rate on necessary items to minimize the regressive impact of tax. The standard GST rate varies from 15 per cent to 20 per cent in most of the countries.[4]

In this section, an attempt has been made to examine global experiences in Goods and Services Tax.

Australia

In Australia, GST was introduced on 1st July, 2000 by the Howard Government by passing Goods and Services Tax Act, 1999. The main objective of new tax was to broaden the tax system. Australia replaced a range existing taxes viz. Wholesale Sales Tax (WST), Debit Tax, financial institutions duty and stamp duty on shares, leases, mortgage, cheques, etc by imposing 10 per cent tax on goods and services. The GST collected by the government was to be redistributed among six states and two territories on the principle of Horizontal Fiscal Equalization (HFE) according to the recommendations of Commonwealth Grants Commission (CGC).[5] The objective was to achieve equality in the provision of services and infrastructure. Australia also introduced a variety of measures to soften the extra financial burden of GST.[6]

New Zealand

Goods and Services Tax is a Value Added Tax, introduced on October 1, 1986 as a part of comprehensive tax and welfare reform. It was introduced when the economy of the New Zealand was in crisis. First, GST was introduced at 10 per cent which increased to 12.5 per cent (1989) and again increased to 15 per cent (2010) in expectation of mobilizing higher revenue and removing distortions in the tax structure. This led to adoption of GST at a single rate with almost no exemptions. GST broad based the tax net and reduced both compliance and administrative cost by food in the GST base at the full rate. New Zealand is one of the highest tax productive nations among OECD countries with a standard rate lower than in most other OECD countries with almost no exemptions.[7]

Canada

The GST was introduced in Canada in 1991 to replace the 13.5 per cent Manufacturers' Sales Tax (MST). It is a multi-level VAT which is levied on supply of goods and services. However, certain items have not been covered under GST such as medical services, financial services, residential rent, groceries and export. GST was introduced keeping in mind the problem of cascading. Thus, it was insured that addition of value at each stage of supply chain is not taxed more than once.[8]

Singapore

GST was introduced in Singapore in 1994 with the objectives to broaden the indirect tax base, to offset the loss in revenue and to make the tax base strong. This was also introduced to support the needy and underprivileged. Imposition of GST and reduction in other taxes was collectively done in order to make it acceptable to the public and reduce the impact of inflation. Initially, the rate of GST was 3 per cent but later on, it increased to 4 per cent in January 2003 and further to 5 per cent on January 1, 2004 and finally to 7 per cent on 1st July, 2007. The

government also decided to introduce a GST Compensation Scheme to aid the poor and needy class of the society.

Brazil

The main state tax of Brazil is the Tax on Circulation of Goods and Services. It is applicable with circulation of goods transport either manufacturing or marketing or import. It is also applicable on interstate and inter-municipal transport and communication services. The system is non-cumulative and the tax due may be offset by credits from the purchase of raw materials, intermediary products and packaging materials. Tax credit for goods destined to become fixed assets may be accepted under certain restrictions.

Malaysia

GST was introduced in Malaysia in 2015 after a long debate since 1989. The large expatriate work force in Malaysia was benefited by economic growth but they were exempted from income tax. This was one of the major reasons for implementation of GST in Malaysia. Again, the shadow economy of Malaysia was around 30 per cent which showed a vast scope for tax revenue. The standard rate was 6 per cent which was relatively low compared to the VAT rates in other ASEAN countries. The outcome of implementation of GST in Malaysia was reduced because the tax burden was shifted from manufacturers to consumers.

Denmark

GST was implemented in Denmark in 1967 applied on one rate with few exceptions. The current standard rate is 25 per cent which is considered highest along with Norway and Sweden. Though the number of services viz. public transportation of private persons, health care services, publishing newspapers, rent of premises with certain exceptions and travel agency operations are not taxable.

Bangladesh

Value-added Tax in Bangladesh was introduced in 1991replacing Sales Tax and majority of Excise Duties. The Value Added Tax Act, 1991was enacted that year and VAT started its passage from10 July 1991. This day is observed as National VAT Day in Bangladesh. During this period, VAT has become the largest source of government revenue and about 56 per cent of total tax revenue is VAT revenue in Bangladesh. The standard VAT rate is 15 per cent. Export is zero-rated. Apart from these rates, there are several reduced rates locally called Truncated Rate for service sectors that are available. There are other several different rates applicable to different services. Truncated rates are 1.5 per cent, 2.25 per cent, 2.5 per cent, 3 per cent, 4 per cent, 4.5 per cent, 5 per cent, 5.5 per cent, 6 per cent, 7.5 per cent, 9 per cent and 10 per cent.

Bangladesh VAT is characterized many distortions, i.e., value declaration for products and services, branch registrations, tariff values, truncated rates, many restrictions on credit system, lump-sum VAT package VAT) advance payment of VAT, excessive exemptions, etc. For many distortions, VAT-GDP ratio is about 4 per cent in Bangladesh. To increase the productivity of VAT, Government enacted the Value Added Tax and Supplementary Duty Act, 2012. This law was initially scheduled to operate with an automated administration from 1 July 2017.[9]

Finland

The standard rate for VAT is 22 per cent in Finland. Apart from this rate, there are two other reduced rates which are in use. First is 17 per cent which is applicable with food and animal feed and second is 8 per cent which is applicable with passenger transportation services,

cinema performances, physical exercise services, books, pharmaceuticals, entrance fees to commercial cultural and entertainment events. Further, supply of certain goods and services are exempt under conditions mentioned in the Finnish VAT Act. These goods and services are hospital and mental care, social welfare, educational, financial and insurance services, lotteries and money games, transactions regarding bank notes and coins, real property including land and building, certain transactions carried by blind and deaf persons.

Sweden

VAT was implemented in 1969 with split into three levels:
(i)   25 per cent rate is applicable with most of goods and services including bills of restaurants.
(ii)   12 per cent for foods (including home take from restaurants and hotel stays excluding breakfast).
(iii)   6 per cent for printed matter, cultural services and transport of private persons.

However, some services (education for children) are not taxable but education for adults, dance events for guests have 25 per cent, concerts and stage shows have 6 per cent and some types of cultural events have zero per cent.

Norway

Like Sweden, VAT in Norway is also split into three levels. The general VAT is 25 per cent. However, 14 per cent is for foods and restaurant take out (25 per cent for food eaten at restaurant) and 8 per cent is for person transport, movie tickets and hotel stays while books and newspapers are free from VAT.

European Union

The European Union Value Added Tax is value added tax comprising member states in the European Union Value Added Tax Area. This is compulsory for member states of European Union and has to abide with the provisions of EU VAT laws as set out in Directive 2006/112/EC. According to this Directive, member states must have a minimum standard rate of 15 per cent and one or two reduced rates not to be below 5 per cent. Few member states have zero per cent VAT rate while the current highest rate in EU is 25 per cent. However, the member states are free to set higher rates of VAT.[10]

Argentina

In Argentina, the VAT is split in various levels. 27 per cent is the special high rate for telecoms, domestic gas supplies, water and industrial agency users while 21 per cent is the standard rate applicable to all other taxable goods and services, 10.5 per cent is applicable to medical, fruit, pulses, vegetables, meat, taxi transport. However, there is another 2.5 per cent rate applicable to printed and digital newspapers and magazines.

Japan

Japan introduced the consumption tax in the year 1989 at a rate of 3 per cent. This percentage increased to 5 per cent in 1997. In 2012, the tax was doubled to 10 per cent. Later on, the Shinzo Abs government was not agree to increase until April 2017. A second postponement to increase the rate was announced in 2016 which pushed the increase to October 2019.

China

The standard rate of VAT/GST in China is 16 per cent. However, 13 per cent rate was for certain agricultural produces, cereals, books, newspapers, public water supplies, etc; 10 per cent for retail, entertainment, hotels, restaurants, real estate and construction, transport and logistics

since May 1, 2018; 6 per cent for financial services and insurance, telephone and internet data, IT, City Maintenance and Construction, etc; 3 per cent for Chinese National Education Tax and 2 per cent for Chinese Local Education Tax.

Germany

In Germany, the standard VAT/GST rate is 19 per cent. However, 7 per cent reduced rate is on some foodstuff, domestic passenger transport, rail and inland waterway transportation, books (excluding e-books), newspapers, periodicals, social services, medical and dental care, take away food, etc.

Hungary

The standard VAT or GST rate in Hungary is 27 per cent. However, 18 per cent reduced rate is applicable with certain foodstuffs, pharmaceuticals products, medical equipments for disabled persons, newspapers, periodicals and some supplies for new building.

Italy

Italy has three reduced VAT rates. 10 per cent reduced rate is applied to basic foodstuffs, domestic energy and telephone, 5 per cent reduced rate on social and health services; 4 per cent on live stock, print newspapers and zero per cent reduced rate on export of goods and services with some exceptions.

Luxembourg

Like some countries, Luxembourg also has three reduced VAT rates. 14 per cent reduced VAT rate is on securities management, heating oil, wine; 8 per cent reduced VAT rate on heating gas, domestic electricity, horticulture and 3 per cent VAT rate on e-books, books and journals, foodstuffs, passenger transport, restaurants, hotels, TV broadcasting, etc.

Mexico

The standard VAT or GST rate in Mexico is 16 per cent while 8 per cent reduced VAT rate for businesses providing services with effect from January 1, 2019 and zero per cent rate on exports for medicine, agricultural services, milk, wheat, meat and corn.

Romania

The standard VAT or GST rate in Romania is 19 per cent while 9 per cent reduced VAT rate is on hotels, cultural events, medicines, books and journals and 5 per cent reduced rate is on social housing, books excluding e-books), newspapers, periodicals, admission to cultural and sports events.

Switzerland

In Switzerland, the standard VAT or GST is 7.7 per cent while 3.7 per cent reduced VAT rate is on hotel accommodation and 2.5 per cent reduced VAT rate is on some basic foods, agricultural supplies, water, printed materials and sporting events.

Conclusion

Thus, it can be deduced that GST is also known as the National Value Added Tax (VAT) and has been introduced in more the 160 countries in the world. Most of the countries have a unified GST system. Brazil and Canada follow a dual system where GST is levied by both Union and the state governments. France was the first country to introduce GST system in 1954. The standard GST rate in most of the countries varies between 15to 20 per cent. In almost all the countries, most of the sectors have been taxed except few exemptions.

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Introduction

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From a global perspective, India has joined GST bandwagon quite late.[3] After 1954, around 160 nations have introduced GST in their taxation system. However, given the size and scale of India and its federal structure, introducing GST will be regarded as a major financial reform. GST follows principles of value added taxes (VAT) and shifts the focus of the country from a consumption-based tax system to a supply-based tax system. One may regard GST as one of the most debated topics, not only in India but across the world. Globally, the principles of GST follow the best practices and accordingly India has picked up such global best practices and modified it to suit the economic and practical needs of the country. As of 2017, out of 193 countries in the world, 160 countries have implemented the indirect tax in the form GST or VAT. So there was no reason for the fastest growing economy in the world to ignore such type tax system and continue with a series of traditional taxes including excise tax, sales tax and service tax.

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Sweden

VAT was implemented in 1969 with split into three levels:

(iv)   25 per cent rate is applicable with most of goods and services including bills of restaurants.

(v)   12 per cent for foods (including home take from restaurants and hotel stays excluding breakfast).

(vi)   6 per cent for printed matter, cultural services and transport of private persons.

However, some services (education for children) are not taxable but education for adults, dance events for guests have 25 per cent, concerts and stage shows have 6 per cent and some types of cultural events have zero per cent.

Norway

Like Sweden, VAT in Norway is also split into three levels. The general VAT is 25 per cent. However, 14 per cent is for foods and restaurant take out (25 per cent for food eaten at restaurant) and 8 per cent is for person transport, movie tickets and hotel stays while books and newspapers are free from VAT.

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The standard rate of VAT/GST in China is 16 per cent. However, 13 per cent rate was for certain agricultural produces, cereals, books, newspapers, public water supplies, etc; 10 per cent for retail, entertainment, hotels, restaurants, real estate and construction, transport and logistics since May 1, 2018; 6 per cent for financial services and insurance, telephone and internet data, IT, City Maintenance and Construction, etc; 3 per cent for Chinese National Education Tax and 2 per cent for Chinese Local Education Tax.

Germany

In Germany, the standard VAT/GST rate is 19 per cent. However, 7 per cent reduced rate is on some foodstuff, domestic passenger transport, rail and inland waterway transportation, books (excluding e-books), newspapers, periodicals, social services, medical and dental care, take away food, etc.

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In Switzerland, the standard VAT or GST is 7.7 per cent while 3.7 per cent reduced VAT rate is on hotel accommodation and 2.5 per cent reduced VAT rate is on some basic foods, agricultural supplies, water, printed materials and sporting events.

Conclusion

Thus, it can be deduced that GST is also known as the National Value Added Tax (VAT) and has been introduced in more the 160 countries in the world. Most of the countries have a unified GST system. Brazil and Canada follow a dual system where GST is levied by both Union and the state governments. France was the first country to introduce GST system in 1954. The

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EVA as a performance measurement tool in comparison to traditional measures in select Central Public Sector Undertakings in India

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ABSTRACT
Economic Value Added is a residual performance measurement index which is becoming increasingly popular among the huge corporate giants internationally and nationally. Economic Value Added is preferred by most of the corporate houses over traditional performance measures like ROI, EPS etc. A host of corporate houses have already taken EVA as a corporate measurement tool seeking reason that it clearly depicts the actual picture of the performance of the corporate and helps in generating shareholders wealth. In this research paper the researchers has made an attempt to make a comparative analysis of EVA with other traditional measures by applying it on select central public sector giants operating in India focusing mainly on those accorded with Maharatna status.
Key words: Economic Value Added, Traditional measures, Market Value Added, CPSE, shareholders wealth.

INTRODUCTION

Economic Value Added is a new corporate paradigm which has taken over the corporate world with its clear depiction of the value generated by the corporate at the end of one operating year. The concept of value addition was put forth by management guru Peter F Drunker long back even Nobel Laurent's like Modigliani and Miller were seen to have propagated the concept of value addition. But the concept of value addition actually became popular when Stern Stewart named it as Economic Value Added. Economic value added is nothing but a modern measure to evaluate an investment centre. It is the residual amount that remains with the corporate houses after paying off everyone whom the company owes. The basic difference between EVA and traditional performance measure is that EVA takes forth the cost of capital that the company is supposed pay to the shareholders for investments made. In EVA the cost of capital is deducted from the Net Operating Profit after taxes to give rise to what is known as Economic Value Added. The concept of EVA states that a company is considered to have created wealth or generated profit only if it has a residue left after paying of its cost of capital, otherwise the company is considered to be in a no profit no loss situation if it's just able to meet its cost of capital and to have destroyed its wealth if its unable to meet is cost of capital.

Conceptually Economic value added is considered superior over traditional measures because it moves one step ahead by taking into consideration cost of capital where traditional measures stops by just comparing the profit with that of investments made.

EVA AND MVA (MARKET VALUE ADDED)

Market Value Added or MVA is the shareholders wealth that is generated by the company. It is calculated by deducting the book value of the capital from its market value . The resultant is called the market value added i.e it is the value added to the shareholders wealth over

and above the invested capital. If the figure so generated is positive wealth is considered to have been created and if the resultant is negative wealth is considered to have been destroyed. Hence MVA=(market value of equity+ market value of debt) – (book value of equity   +book value of debt)

For the purpose of calculation of debt in this research work debt is kept away from the purview of market value added as the market value of debt seldom changes and moreover it is difficult to measure the market value of debt, while its market value is almost equal to the book value t not making any sever impact in the equation. Hence for the purpose of the study

MVA= Market Value of Equity- Book Value of Equity

=(Market price x outstanding equity) - Book value of equity

CALCULATION OF EVA

As stated earlier EVA is nothing but the residue or the amount that remains in the hands of the company after paying off cost of capital hence EVA is calculated by deducting the weighted Cost of capital from the net operating income after taxes popularly known as NOPAT. Arithmetically

EVA= NOPAT- WACC x TC

Arriving at NOPAT

NOPAT or Net Operating Profit after Taxes is the profit that remains in the hands of the company after paying off interest and taxes. The significant difference between EVA and Traditional measure is that EVA as prescribed by Stern Stewarts needs to get away with the accounting distortions i.e. EVA moves away from accrual basis to a cash basis of accounting. EVA in reality deviates from the Generally Accepted Accounting Principles. Here non cash transactions like depreciation, amortization of goodwill etc are added back or deducted from the operating profit as it appears in the profit or loss or balance sheet to arrive at the NOPAT for the purpose of calculation of EVA, citing reasons that in reality no cash moves in or away from the corporate leaving disposable income in the hands of the company which can be utilized for generating shareholders wealth. Stern Stewarts and his company have identified 120 such accounting distortions. For the purpose of the study the researcher have taken up four very commonly used distortions by researchers which are conducive for Indian companies namely goodwill, bad debts, Research and development expenses and LIFO/FIFO adjustments

Arriving at WACC

WACC or Weighted Average Cost of Capital is arrived at by taking into two basic components of capital equity and debts

Formula

Cost of debt : cost of debt is calculated by applying the simple formula for arriving at cost of debt

$$\text{Cost of debt } = \frac{total\ amount\ of\ interest\ (1-tax)}{total\ debt}\ x100$$

Cost of equity= Cost of equity for the purpose of calculation of equity is measured by using the CAPM method of calculating market return

$R_e = R_f - \beta(R_m - R_f)$

$R_{f\ =}$ Risk free rate

R_m = Market return

β = Beta

Risk free rate: in reality there is nothing called risk free rates when it comes to securities as no securities are completely risk free but government securities or gilt edge securities are considered comparatively risk free. Hence interest on the treasury bills are considered as the risk free rates. For the pupose of the study 10 year T bill for the period of the study has been considered as the R_f or risk free rates.

Beta : Beta is the volatility of the stock market. Beta is calculated as

$$R_i = \frac{Closing\ Prices\ of\ Security\ on\ day\ t - closing\ prices\ of\ security\ on\ day\ t-i}{Closing\ prices\ of\ security\ on\ day\ t-1}$$

Where R_i is the return on security i on day t

Beta coefficient has been calculated as

$B_j = COV_{im}/\sigma_m^2$

Where COV_{im} the covariance between security return and market is return and σ_m^2 is the variance of market return

Market return: for the purpose of the study to represent the market return of NSE for CPSE the market return of CPSE indices for the period of the study has been used by the researchers

OTHER TRADITIONAL MEASURES

In this research work the researchers have made an attempt to make a comparative analysis of EVA with other traditional measures. Traditional measures include Return on Investment (ROI), Return on Net Worth(RONW), Earnings Per Share(EPS), etc but for the purpose of the study only ROI and EPS has been taken as base to measure the effectiveness of EVA over other traditional measures

Return on Investment (ROI) : return on investments as the name suggest is calculated by comparing the return that is the profit after interest and tax with the invested capital

$$ROI = \frac{Profit\ After\ tax}{Investment}$$

Earnings per Share(EPS) : earnings per share is the earnings or return per share earned against every share. It is calculated by dividing the net profit with the outstanding shares

$$EPS = \frac{net\ profit\ after\ tax}{equity\ share\ capital}$$

REVIEW OF LITERATURE

While conducting the research work the researcher have come across various literature related to EVA which includes

Mc Cormack and Vytheeswaram(1998) the researcher performed econometric tests on financial relations for the largest oil companies for the period 1997-2001. The Change in shareholders wealth is tested against EBIT, RONA, after tax earnings,ROE and free cash flow.

M.Kakati (2005) the researcher examined four aspects of valuation process which include i)factors/variable considers while doing valuation ii)sources of information iii) forecasting techniques used and iv) valuation methodology based on a pilot survey of 80 variables profounded that EVA is losing its popularity because of data intensity and too many adjustment required for changes in data

Anil Misra&Anil Kanwal(2007) has made an attempt to find out whether EVA finds a better reflection in the firm's stock prices in comparison to traditional accounting based

measures. The researcher has tested the hypothesis on the time series data of 'A' group companies listed in Bombay stock exchange with the help of cross sectional analysis of the sample firm using regression analysis

Bhagaban Das (2009) this article discusses the development of economic value measures especially Economic Profit/EVA, which is Found to be superior to other accounting based measures. The method of computation of Economic profit and the benefits and criticism also form a part of this paper

Abdullah Al Mamun&Shazali Abu Mansor(2012) this study intended to identify why EVA should be used as financial performance measure over the conventional measure and its added advantage in using EVA compared to conventional methods. The researcher identified EVA as an important financial performance measurement tool over the conventional tool around the world.

BabliDhiman, ShipraPruthi (2012) in their research work the researcher has made to known which company is a wealth generator for shareholders in Indian parlance. For this purpose the researchers have made a study on nifty fifty over the period 2005-2010

OBJECTIVES

1. To compute and analyze the Economic Value Added of the select central public sector units
2. To make a comparative analysis of the economic value added with the traditional performance measure ROI and EPS

RESEARCH METHODOLOGY

   For the purpose of the research the researchers have designed a methodology to achieve the set objectives

Sample size

 For the purpose of the study the researcher have selected threecentral public sector units namely

1. Oil and Natural Gas corporation
2. National thermal Power Corporation
3. Steel Authority Of India

The three companies have been select on the basis of convenience of the researcher there are total seven central public sector units accorded with Maharatna status. the researcher have selected three on the basis of convenience and judgment keeping in mind that all the companies selected are listed in a recognized stock exchange i.e NSE

Source of data

The study completely deals with secondary data. For the purpose of the study annual reports of the companies have been collected along with the annexure with the help of Capitaline Database and other information required for the purpose of calculation of EVA has been collected from the company website.

Apart from the annual reports various journal, e-journals, magazines, books relating to concept have be consulted during the course of the study

 For the purpose of calculation of EVA the cost of capital is calculated with the help of CAPM model which requires risk free return which is taken from the RBI annual reports while market return is been calculated by taking into account NIFTY CPSE indices .Hence the NSE

and RBI websites have been used for the purpose of the study. The period of the study is from 2013-14 to 2017-18

DATA ANAYSIS AND INTERPRETATION

Table 1.

Computation of EVA of ONGC LTD   (*amt in crores*)

Year Ending March 31st 2014		2015	2016	2017	2018
Share capital	4277.76	4277.76	4277.76	6416.63	6416.63
Debt capital	0	1393.00	0	0	25592.21
Beta variant	1.27	1.10	1.15	1.06	0.99
Risk free debt	7.60	7.60	7.60	7.60	7.60
Market return	7.56	20.16	25.20	-25.20	- 4.03
Cost of equity	7.48	21.41	27.84	-27.20	-3.9
Cost of debt	0	0.14	0	0	0.21
WACC	7.48	16.18	27.84	-27.2	-0.64
NOPAT (adjusted)	22,095.17	17,735.95	17,464.06	19,121.72	21,453.75
tc*wac	319.97	917.52	1190.92	-1745.15	-204.85
EVA	21,775.20	16.818.43	16,273.14	20866.87	21658.60.

Source: self compiled

The table above depicts the Economic Value Added created or destroyed by the corporate during the time period 2014-2015. Its observed that the corporate have persistently created wealth during the time frame

Table 2.

Computation of EVA of SAIL LTD   (*amt in crores*)

Year Ending March 31st 2014	2015	2016	2017	2018
Share capital 4130.53	4130.53	4130.53	4130.53	4130.53
Debt capital	25,281.40	29897.73	34979.79	41395.65 45408.72
Beta variant	0.73	0.80	1.03	1.17 1.10
Risk free debt	7.60	7.60	7.60	7.60 7.60
Market return 7.56	20.16	25.20	-25.20	- 4.03
Cost of equity 7.57	17.64	25.27	-30.77	-5.19
Cost of debt	0.76	4.80	6.50	6.10 6.21
WACC	1.71	6.35	8.40	2.75 5.26
NOPAT (adjusted)	3584.12	3546.91	-1720.99	-305.42 2341.00
tc*wac	344.11	2160.79	3285.26	1251.95 2605.76
EVA	3240.01	1386.12	-5,006.25	-1557.37 -264.76

The table above depicts the EVA created or destroyed during the period 2014-2018. It was observed that during the last three years the corporate have destroyed wealth which also reflects in their profit.

Table 3

Computation of EVA of NTPC LTD   (*amt in crores*)

Year Ending March 31st	2014	2015	2016	2017	2018
Share capital	8245.46	8245.46	8245.46	8245.46	8245.46
Debt capital	67170.22	85995.34	93127.24	106840.21	121604.60
Beta variant	0.46	0.70	0.60	0.53	0.42
Risk free debt	7.60	7.60	7.60	7.60	7.60
Market return	7.56	20.16	25.20	-25.20	- 4.03
Cost of equity	7.50	16.39	18.16	-9.70	2.70
Cost of debt	2.93	2.31	3.59	2.80	3.02
WACC	2.87	3.53	4.69	1.90	2.99
NOPAT (adjusted)	22,095.17	17,735.95	17,464.06	19,121.72	21,453.75
tc*wac	2164.43	3326.70	4754.37	2186.62	3882.51
EVA	19930.74	14409.26	12709.69	16935.10	17571.24

The above table depicts the EVA created or destroyed by the corporate giant during the time period 2014-2018 its observed that the corporate have persistently generated wealth with a positive EVA during the period.

Table 2. Calculation of MVA

Company	2013-14	2014-15	2015-16	2016-17	2107-18
ONGC	90,755.68	82,850.5	36,326.23	22,015.36	47,303.17
NTPC	13,044.22	39,429.5	15,814.62	40,641.58	38,151.46
SAIL	-13,176.29	-15,662.85	-21,247.29	-10,607.12	-6,716.19

Source: self complied

From the above table it has been observed that SAIL has negative MVA throughout the time period while ONGC and NTPC has a positive and increasing market value which is also true in terms of EVA.

Table 4. Calculation of ROI

Company	2013-14	2014-15	2015-16	2016-17	2107-18
ONGC	516	321.70	377.29	278.96	62.31
NTPC	14.55	10.91	10.62	8.15	7.9
SAIL	8.8	6.14	-10.28	-6.2	-0.9

Table 4 depicts the Return on investment of the selected CPSE's. it is seen from the table that ONGC has are remarkable return on investment as compared to NTPC while SAIL has a negative return on investment.

Table 5. Calculation of EPS

Company	2013-14	2014-15	2015-16	2016-17	2107-18
ONGC	24.21	18.83	18.83	13.95	15.54
NTPC	12.33	11.97	12.74	10.85	11.99
SAIL	5.99	4.67	0	0	0

Source: self complied through calculation

From the table above it is seen that the earnings per share of ONGC is decreasing while that of NTPC is constant and that of SAIL is very poor and almost nil in most of the years.

FINDINGS OF THE STUDY

1. The study reveals that corporate like ONGC and NTPC has been persistently creating wealth while SAIL has destroyed wealth during the time frame as it generates a negative EVA. The wealth destroyed also depicts in their operation as they have not earned any profit for the last three years. The basic idea behind EVA is that shareholders must earn a return that is sufficient to compensate for the risk taken by them which was otherwise missing in traditional accounting techniques.

2. EVA clearly depicts the wealth created or destroyed by the corporate during a time period by taking into consideration volatility of the market along with cost of capital and cost of debt which is ignored in other traditional measure .As it has been seen that ONGC &NTPC has been persistently creating wealth while SAIL though a corporate giant has been destroying wealth which clearly depicts while calculating EVA while ROI and EPS is silent about the cost of capital and wealth destroyed by the corporate. As per the analysis done by the researcher the problems of undercapitalization and overcapitalization can be easily detected by the application of EVA.

3. From the analysis the researchers concludes that conventional performance measures such as Return On Investment (ROI), or earning-per-share are deficient because they are one-dimensional and are unable to fully assess the firms' strategic accounting, outcomes and performance. It is also seen from the analysis that the traditional measures reflect only past performance and has significantly no emphasising on future performance. Moreover, it's been argued by the researchers that EVA facilitates better goal congruence than ROI i.e wealth maximization. EVA helps overcome the goal incongruence that exists between the manager and the firm which cannot be resolved by using ROI as it lays no emphasis on wealth created or destroyed which has a direct relation with effective investments.

4. The superiority of EVA can be also judged from the perspective of MVA as a positive and high EVA also results into high and increasing MVA as seen in the tables above where companies with positive and high EVA hs also positive and high MVA. Thus a

positive EVA creates a positive MVA. EVA actually clarifies considerably the concept of profitability unlike traditional measure.

5. EVA tries to move from stringent accounting principles to modern financial economics to provide a more accurate measure of the weighted average cost of capital (WACC). Instead of using the profit, as computed under Generally Accepted Accounting Principles (GAAP),EVA encourages to do away with accounting distortions which leads to a clearer disposable income in the hands of the mangers.

6. The corporate procedures have undergone through deep rooted changes. Hence in this changing environment measures which do not take into considerations the risk and return associated with investment cannot be considered as a suitable performance measure. The performance measures which neglects the expected return by shareholders leaves its shareholders unaware about their as well as their as well as the corporate position.

SUGGESTIONS AND CONCLUSION

Economic value added is a performance measure which is definitely more informative and thus reveals a lot about the organizations performance. The procedure for computation is more scientific and more justified in comparison to other traditional measure as important aspects like cost of capital, volatility of the market are not looked after which is ignored by other measures like EPS and ROI. While the procedure of calculating cost of capital is relation to the stock market gives it an edge and helps shareholders to know about their position in the concern and also gives an idea when to exit or enter the market. This measure gives more emphasis on value creation hence value is so created only by careful deployment of funds hence management needs to be vigilant in investment of funds so that they generate more wealth which leads to good corporate governance.

Yet this measure suffers from being complicated in its procedure of calculation as compared to traditional measures and moreover there is no set rules or standard which gives guidelines about its universal applicability hence brings a biasness of the organization who applies it along with that the applicability of this method is more expensive in comparison to its benefits derived. Moreover it is not made mandatory for firms to disclose its value addition.

Hence to make it a more effective performance measure it is important to give it a universal applicability and bring in guidelines related to the procedure of calculation. If a proper framework is designed for its calculation it can be made mandatory as EVA in reality disclose more and accurate information related to an enterprise.

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A STUDY OF RELATIONSHIP   BETWEEN PROBLEM SOLVING ABILITY AND ACADEMIC ACHIEVEMENT OF IX STANDARD STUDENTS

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Abstract
The main aim of the present study was to investigate the relationship between   problem solving ability and academic achievement of IX standard students from the Davanager district of Karnataka state.   A total number of 200 students were selected by using random sampling technique for analysis of data correlation technique as adopted, problem solving ability in science scale was standardized by L.N.Dubey and   academic achievement test constructed by the investigator were administered to collect the required data and the proper objectives were framed and the null hypotheses were setup to test the objectives also the normative survey method was used. For analysis of data simple correlation technique was adopted. The procedure of data collection was also followed. The results of the study reveals that there is a positive and significant relationship between problem solving ability and academic achievement of boys and girls, rural and urban, government and private and Kannada and English medium students   studying in different   secondary schools. Further, it shows that the mean scores of   problems solving ability is more than the academic achievement of students.

Introduction
        Problem solving is a process of overcoming difficulties that appear to interfere with the attainment of a goal. Simple problems can well be solved by instinctive and habitual behaviours. More difficult problems require a series of solution attempts, until the successful solution is reached problems still more difficult require a degree of understanding, a perception of the relationship between the significant factors of a problem. In general the state of tension is created in mind when an individual faces a problem. He exercises his greatest effort and uses all his abilities, intelligence, thinking, imagination, observation etc. some individuals are able to solve problems sooner than others. That indicates that there are levels of problems solving ability ranging from average ability to highest ability depending upon the difficulty level of the problem.

Objectives
The following objectives were framed for the present study
    1.   To investigation the relationship between problem solving ability in science and academic achievement of girls.
    2.   To investigation the relationship between problem solving ability in science and academic achievement of boys.

3.   To investigation the relationship between problem solving ability in science and academic achievement of rural students.

4.   To investigation the relationship between problem solving ability in science and academic achievement of urban students.

5.   To investigation the relationship between problem solving ability in science and academic achievement of   students studying in government schools.

6.   To investigation the relationship between problem solving ability in science and academic achievement of   students studying in private schools.

7.   To investigation the relationship between problem solving ability in science and academic achievement of   students with Kannada medium.

8.   To investigation the relationship between problem solving ability in science and academic achievement of   students with English medium.

Hypotheses

The following null hypotheses were set up to test the objectives 1-8
for the present study.

1. There is no significant relationship between problem solving ability in science and academic achievement of boys.

2. There is no significant relationship between problem solving ability in science and academic achievement of girls.

3. There is no significant relationship between problem solving ability in science and academic achievement of rural students.

4. There is no significant relationship between problem solving ability in science and academic achievement of urban students.

5. There is no significant relationship between problem solving ability in science and academic achievement of   students studying in government schools.

6. There is no significant relationship between problem solving ability in science and academic achievement of   students studying in private schools.

7. There is no significant relationship between problem solving ability in science and academic achievement of students with Kannada medium.

8. There is no significant relationship between problem solving ability in science and academic achievement of students with English medium.

Method Used

   For the present study normative survey method was adopted which is capable of rendering important service, as it determines the present trends and helps to solve current problems in practical way. It can suggest course of future developments and contribute to the advancement of knowledge. Hence the present study is selected by using survey method.

Sample

   It represents a total sample of 100 secondary school students studying in IX standard were selected using random sampling technique.

Tools

The following tools were used to collect the data from secondary school students from Davangere district

1. Problem solving ability scale developed and standardized by L.N. Dubey and
2. Academic achievement test constructed   by   the investigator.

Data collection

To collect the necessary data for the study printed copies problem solving ability scale and academic achievement test   respectively. Two scales were administered to IX standard students studying in secondary schools of Davangere District. All the necessary steps of data collection procedures were followed systematically.

Statistical Analysis

In pursuance of the objectives of the study as well as to test the hypotheses the correlation statistical technique was adopted.

Table–1. Correlation of Mean, SD and 't' Value between Problem Solving Ability and Academic Achievement of Boys

Variables	Mean	Std. Dv.	Correlation Coefficient	t-value	p-value	Signi.
Problem Solving Ability	172.2500	14.6110	0.4850	4.6862	<0.05	S
Academic Achievement	317.5600	30.1301				
Correlation between Problem Solving Ability and Academic Achievement of Girls Students						
Problem Solving Ability	275.1000	12.0835	0.3453	0.4468	0.05	S
Academic Achievement	331.5400	31.5835				

The obtained 't' value is greater than the tabled value at 0.01 level of significance (r=0.4850, t= 4.6862). This shows that there is a positive and significant relationship between problem solving ability and academic achievement of boys. Obtained 't' value is greater than the tabled value at 0.05 level of significance (r=0.3453, t= 0.4468). It shows that there is a positive and significant relationship between problem solving ability and academic achievement of girls students.

Table–2. Correlation of Mean, SD and 't' Value between Problem Solving Ability   and Academic Achievement of Rural   students

Variables	Mean	Std. Dv.	Correlation Coefficient	t-value	p-value	Signi.
Problem Solving Ability	172.8529	17.3067	0.6432	4.7869	<0.05	S
Academic Achievement	313.5000	29.0394				
Correlation of Mean, SD and 't' Value between Problem Solving Ability and Academic Achievement of Urban Students						
Problem Solving Ability	171.9394	13.1452	- 0.3090	2.5980	<0.05	S
Academic Achievement	329.6515	30.6837				

The obtained 't' value is greater than the tabled value at 0.01 level of significance (r= 0.6432, t=4.7869). This shows that there is a positive and significant relationship between problem solving ability and academic achievement rural students. That the obtained 't' value is greater than the tabled value at 0.05 level of significance (r= - 0.3090, t= 2.5980). This shows that there is a positive and significant relationship between problem solving ability and academic achievement of urban students.

Table–3. Correlation of Mean, SD and 't' Value between Problem Solving Ability   and Academic   Achievement of Government School Students

Variables	Mean	Std. Dv.	Correlation Coefficient	t-value	p-value	Signi.
Problem Solving Ability	165.8529	17.3067	0.6454	4.7818	<0.05	S
Academic Achievement	303.5000	20.0394				

Correlation of Mean, SD and 't' Value between Problem Solving Ability and Academic Achievement of Private School Students						
Problem Solving Ability	171.9394	13.1452	0.3190	2.5991	<0.05	S
Academic Achievement	319.6515	30.6837				

The obtained 't' value is greater than the tabled value at 0.05level of significance (r= 0.6454 , t= 4.7818). This shows that there is a positive and significant relationship between problem solving ability and academic achievement of government school students. The obtained 't' value is greater than the tabled value at 0.05 level of significance (r= 0.3190, t= 2.5991).This shows that there is a positive and significant relationship between problem solving ability and academic achievement of private school students.

Table–4. Correlation of Mean, SD and 't' Value between Problem Solving Ability   and Academic   Achievement of Kannada medium Students

Variables	Mean	Std. Dv.	Correlation Coefficient	t-value	p-value	Signi.
Problem Solving Ability	271.9393	13.1362	0.4089	2.5871	<0.05	S
Academic Achievement	219.6514	40.6836				
Correlation of Mean, SD and 't' Value between Problem Solving Ability and Academic Achievement of English medium Students						
Problem Solving Ability	261.7801	25.8328	0.3782	2.8135	<0.05	S
Academic Achievement	326.3510	33.4965				

 S=Significant at 0.05 level

The obtained't' value is greater than the tabled value at 0.05 level of significance (r= 0.4089, t= 2.5871). This shows that there is a positive and significant relationship between

problem solving ability and academic achievement of Kannada medium students. The obtained 't' value is greater than the tabled value at 0.05 level of significance (r= 0.3782, t= 2.8135). This shows that there is a positive and significant relationship between problem solving ability and academic achievement of English medium students.

Results of Tables 1-4
1. There is a positive and significant relationship between problem solving ability and academic achievement of boys and girls students.
2. There is a positive and significant relationship between problem solving ability and academic achievement of rural and urban students.
3. There is a positive and significant relationship between problem solving ability and academic achievement of government and private school students.
4. There is a positive and significant relationship between problem solving ability and academic achievement of Kannada and English medium students.

Educational Implications

There is very much influence of problem solving ability on the academic achievement of students. Problem solving is an individualized process, which requires various strategies to tackle. The classroom teacher can develop a scientific approach to solve problems that the students are expected to face in social life. The implication of this study is that all pupils can be provided an environment, which is suitable according to their behaviour so that their creativity may be flourished. Moreover, home & school can play important roles in developing a positive attitude for the development of creativity among students.   The school teachers are required to be trained for use of diagnostic and criterion based evaluation procedures to make teaching-learning process more effective as well as child centered to enhance level of problem solving ability. The rural students possess significantly higher academic achievement than the urban students. Studies such as this one can assist with the understanding of student's problem solving ability of different locality from an empirical point of view.

Conclusion

On the basis of the findings of the present study the following conclusion could be drawn

There is a positive and significant relationship between problem solving ability and   academic achievement of boys and girls, rural and urban students, government and private school students and Kannada and English medium students studying in secondary schools of Davanagere district.

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A STUDY ON THE FUNCTIONS USED FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATION

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ABSTRACT

The theory of partial differential equations (local and global presence, consistency, disseminating theory) is unfathomable and has been concentrated broadly by numerous creators. Exclusively, the techniques grew so far confine to differential problems with introductory information in problem, basically due to the pivotal pretended by various solutions in the analysis of partial differential administrators. For an example of results and a pleasant prologue to the field, we propose the partial differential equations.

In this note, we concentrate on the solution of partial differential equation. As a rule, differential information in a modulation space is rougher than any given one in a fragmentary potential space and this low-consistency is alluring as a rule. The proposal of partial differential equations were presented by Feichtinger in the 80s and have affirmed themselves of late as the "right" spaces in partial differential analysis. The current paper highlights the functions used for the solution of partial differential equation.

KEYWORDS: Function, Solution, Equation, Partial, Differential

INTRODUCTION

The cooperation of partial differential equation with particle highlights in a few measurements is of both physical and mathematical interests. Such solutions have been seen in the numerical reenactments of the full Partial differential equation system with immediate Kerr ($\chi^{(3)}$ or cubic) nonlinearity in two space measurements (2D). They are short partial solutions that spread without basically changing shapes over a long separation and have just a couple differential equations under their envelopes. They have been discovered valuable as data transporters in correspondence, as vitality sources, switches and rationale doors in optical gadgets.

In one space measurement (1D), the partial differential system modeling equations engendering in nonlinear equation concedes partial differential equations as careful solutions, otherwise called the solitons.

Rather, differential solutions are more strong. The alleged solutions are of numerous scale equations with particular stage/bunch integrity and adequacy elements. Despite the fact that partial numerical reproductions of the full partial differential equation system are inspiring, asymptotic estimate is vital for analysis in a few space measurements. The estimate of partial differential equation system has been broadly examined.

Long equations are all around approximated through envelope guess by the partial differential equations. A correlation between partial differential equation solutions and those of a broadened

equations likewise demonstrated that the estimate works sensibly well on short stable partial differential system.

Mathematical analysis on the legitimacy of partial differential equation estimation of numerical problems has been completed. Be that as it may, in 2D, the envelope estimate with the partial differential equation separates, in light of the fact that basic breakdown of the partial differential equation happens in limited time. Then again, because of the characteristic physical component or partial differential equation, this system itself regularly carries on fine past the problem.

One case is the semi-traditional two level dissipationless partial differential equation system where smooth solutions continue until the end of time. It is subsequently an exceptionally intriguing inquiry how to alter the partial differential equation to catch the right solutions for modeling the engendering and collaboration of numeric system.

FUNCTIONS USED FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATION
In this study, we consider the Spline method concerning the partial differential equations:

$$\begin{cases} i\partial_t u = \sqrt{1 - \Delta}u + F(u) \ \text{ in } \ \mathbb{R}^n \times \mathbb{R}, \ n \ge 3, \\ u(0) = \varphi, \end{cases}$$

$$\tag{1}$$

$$\begin{cases} \partial_t^2 u + (1 - \Delta)u = F(u) \ \text{ in } \ \mathbb{R}^n \times \mathbb{R}, \ n \ge 3, \\ u(0) = \varphi_1, \quad \partial_t u(0) = \varphi_2. \end{cases}$$

$$\tag{2}$$

The nonlinear part F(u) is of Spline type such that $F(u) = V_\gamma(u)u,$ where

$$V_\gamma(u)(x) = \lambda(|\cdot|^{-\gamma} * |u|^2)(x) = \lambda \int_{\mathbb{R}^n} \frac{|u(y)|^2}{|x - y|^\gamma} \, dy.$$

Here A is a non-zero real number and γ is a positive number less than the space dimension n. The equations (1) and (2) can be rewritten in the form of the integral equations

$$u(t) = U(t)\varphi - i \int_0^t U(t - t')F(u)(t')dt',$$

$$\tag{3}$$

$$u(t) = (\cos t\omega)\varphi_1 + \omega^{-1}(\sin t\omega)\varphi_2 - \int_0^t \omega^{-1}(\sin(t - t')\omega)F(u) \, dt',$$

$$\tag{4}$$

where $\omega = \sqrt{1 - \Delta}$ and the associated unitary group U(t) is realized by the transform as

$$U(t)\varphi = (e^{-it\omega}\varphi)(x) \equiv \frac{1}{(2\pi)^n}\int_{\mathbb{R}^n} e^{ix\cdot\xi}e^{-it\sqrt{1+|\xi|^2}}\widehat{\varphi}(\xi)\,d\xi,$$

where $\widehat{g}$ denotes the Fourier transform of g defined by $\widehat{g}(\xi) = \int_{\mathbb{R}^n} e^{-ix\cdot\xi}g(x)\,dx.$

The operators $\cos t\omega$ and $\sin t\omega$ are defined by replacing $e^{-it\sqrt{1+|\xi|^2}}$ with

$\cos(t\sqrt{1+|\xi|^2})$ and $\sin(t\sqrt{1+|\xi|^2}),$ respectively.

If the solution u of (1) or (3) has a decay at infinity and smoothness, it satisfies two conservation laws:

$$\|u(t)\|_{L^2} = \|\varphi\|_{L^2},$$

$$E_1(u) \equiv K_1(u) + V(u) = E_1(\varphi),$$

$$K(u) = \frac{1}{2}\langle\sqrt{1-\Delta}\,u, u\rangle, V(u) = \frac{1}{4}\langle F(u), u\rangle, \tag{5}$$

where $\langle,\rangle$ is the complex inner product in L^2. Also the solution of (2) or (4) or satisfies the conservation law:

$$E_2(u,\partial_t u) \equiv K_2(u,\partial_t u) + V(u) = E_2(\varphi_1,\varphi_2),$$

$$K_2(u,\partial_t u) = \frac{1}{2}(\langle\partial_t u, \partial_t u\rangle + \langle\sqrt{1-\Delta}u, \sqrt{1-\Delta}u\rangle). \tag{6}$$

The main concern of this study is to establish the global well-posedness and scattering of radial solutions of the equations (1) and (2).

The study of the global well-posedness (GWP) and scattering for the semi- relativistic equation (1) has not been long before. In (E. Lenzmann) GWP was considered with a three dimensional Coulomb type potential which corresponds to $\gamma = 1$. The first and second authors of the present study showed GWP for $0 < \gamma \le 1$ if $n \ge 2$ and $0 < \gamma < 1$ if n=1, for $0 < \gamma < \frac{2n}{n+1}$ if $n \ge 2$, and small data scattering for $\gamma > 2$ if $n \ge 3$ In this study we tried to fill the gap $1 < \gamma \le 2$ for GWP under the assumption of radial symmetry. For further study like blowup of solutions, solitary waves, mean field limit problem for semi-relativistic equation, see the references.

The first result is on the GWP for radial solutions of (3).

Theorem 1. Let $1 < \gamma < \frac{3}{2}$ for n = 3 and $1 < \gamma < 2$ for $n \geq 4$. Let $\varphi \in H^{\frac{1}{2}}$ be radially symmetric and assume that $\|\varphi\|_{L^2}$ is sufficiently small if $\lambda < 0$. Then there exists a unique radial solution $u \in C_b H^{\frac{1}{2}}$ such that $|x|^{-1} u \in L^2_{loc} L^2$ of (3) satisfying the energy and L^2 conservations (5).

We mean H^s_2 by H^s and $\dot{H}^s_2$ by $\dot{H}^s$. Hereafter, the space $L^q_T(B)$ denotes $L^q(-T, T; B)$ for $T > 0$ and $\|\cdot\|_{L^q_T B}$ its norm for some Banach space B. If $T = \infty$, we use $L^q(B)$ for $L^q(\mathbb{R}; B)$ with norm $\|\cdot\|_{L^q B}$, $1 \leq q \leq \infty$. We also denote $v \in L^q_T(B)$ for all $T < \infty$ by $v \in L^q_{loc}(B)$

The next result is on the small data scattering of radial solutions of (4.3) for $n \geq 4$

Theorem 2. Let $\frac{3}{2} < \gamma < 2$ for n = 3 and $\frac{3}{2} < \gamma \leq 2$ for $n \geq 4$. Then there is a real number s and ε such that

$$\frac{1}{2} < s < \frac{\gamma}{2}, \quad 0 < \varepsilon < \min\left(\frac{\gamma}{2} - s, s - \frac{1}{2}\right), \quad 1 + s - \varepsilon < \gamma < 1 + s + \varepsilon.$$

$$7)$$

For fixed such s and ε, let $(\varphi_1, \varphi_2) \in D_{s+\varepsilon, s+\varepsilon} \times D_{s+\varepsilon-1, s+\varepsilon}$ be radially symmetric

data. Then if $\|\varphi_1\|_{D_{s+\varepsilon, s+\varepsilon}} + \|\varphi_2\|_{D_{s+\varepsilon-1, s+\varepsilon}}$ is sufficiently small, then there exists a unique radial solution $u \in C_b H^{s-\frac{1}{2}+\varepsilon} \cap L^2 W_{s,\varepsilon}$ to (4.4). Moreover, there exist radial functions $\varphi_1^{\pm} \in H^{s-\frac{1}{2}+\varepsilon}$ and $\varphi_2^{\pm} \in H^{s-\frac{3}{2}+\varepsilon}$ such that

$$\|u(t) - u^{\pm}(t)\|_{H^{s-\frac{1}{2}+\varepsilon}} \to 0 \quad \text{as} \quad t \to \pm\infty,$$

where $u^{\pm}$ is the solutions to the Cauchy problem

$$\begin{cases} \partial_t^2 u^{\pm} + (1 - \Delta) u^{\pm} = 0, \\ u^{\pm}(0) = \varphi_1^{\pm}, \partial_t u^{\pm}(0) = \varphi_2^{\pm}. \end{cases}$$

$$(8)$$

In the definit ion of initial data space $D_{\alpha,\beta}$ the space $L^{\frac{2n}{n+2-2\beta}}$ can be slightly weakened by the homogeneous Sobolev space $\dot{H}^{-(1-\beta)}$. In fact, $L^{\frac{2n}{n+2-2\beta}} \hookrightarrow \dot{H}^{-(1-\beta)}$ for $0 < \beta < 1$. Let $\widetilde{D}_{\alpha,\beta}$ be the weak ened space $H^{\alpha-\frac{1}{2}} \cap \dot{H}^{-(1-\beta)}$. Then one can easily show that the solution $u \in C_b(\mathbb{R}; \dot{H}^{-(1-(s-\varepsilon))})$ and then the existence of scattering   operator   of   (2)   on   a   small   neighborhood   of   the   origin   in $\widetilde{D}_{s+\varepsilon,s-\varepsilon} \times \widetilde{D}_{s+\varepsilon-1,s-\varepsilon}$. For details see Remark M below.

The lower bound $\frac{3}{2}$ of γ is caused by the condition ⫼ which follows from the relation between the weight $|x|^{-a}$ and the L^2 estimate of Bessel function such that

$$\int_0^\infty r^{1-2a} \left| J_{\frac{n-2}{2}}(r) \right|^2 dr < \infty.$$

For the finiteness, the assumption $\frac{1}{2} < a < \frac{n}{2}$ is inevitable because $J_{\frac{n-2}{2}}(r) = O(r^{\frac{n-2}{2}})$ as $r \to 0$ and $J_{\frac{n-2}{2}}(r) = O(r^{-\frac{1}{2}})$ as $r \to \infty$.

For more explicit formula, see the identity below. Hence for the present it seems hard to improve the range of γ for the small data scattering. From the perspective of negative result for the scattering[1], it will be very interesting to show the scattering up to the value of γ greater than 1.

CONCLUSION
In the last few years another numerical technique has been increasingly used to solve mathematical models in engineering research, the spline Method. The spline Method has a few distinct advantages over the Finite Element and Finite Difference Methods. The advantage over the Finite Difference Method is that the spline Collocation Method provides a piecewise-continuous, closed form solution. An advantage over the Finite Element Method is that the spline collocation method procedure is simpler and easy to apply many problems involving differential equations.
Our experimental results nicely confirm the excellent numerical approximation properties of Spline and their unique combination of high computational efficiency and low memory consumption, thereby showing huge improvements over standard finite-element methods.

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Importance of Marketing research in Business

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Abstract

This study provided a deep understanding of the market research and the process which involved and participated in achieving the needed goals. This study also discussed the role of research in building & implementing successful marketing programs. As well as it explained the role of marketing research and its importance in taking the decisions, also we will not forget that this study gave the needed and how we can apply market research on our business.

Keywords: market research, marketing program, market challenge

Introduction:

The principal task of marketing management is to fulfil the aspirations of the consumers. It is thus imperative to understand what the consumers want; how they make the various choice decisions; or what are their sources of information and influence process etc. As such, marketing research is the function which provides the necessary information about the consumer to the marketer. In the process, an organisation can identify new opportunities in the market; evaluate and monitor marketing actions; and in general, evolve better marketing progamme to serve the interests of the consumer. Thus marketing research acts as the link between the consumer and the marketer.

Need and Importance of Marketing Research:

The most important task of a marketer is to get the right product at the right place with the right price to the right person. Besides, it was also necessary to go back and find whether consumer is getting optimum satisfaction, so that consumer remains loyal. These aspects made it imperative for the marketers to conduct marketing research.

The following points explain the need for and importance of marketing research:

1. Identifying problem and opportunities in the market:

It helps in identifying new market opportunities for existing and new products. It provides information on market share, nature of competition, customer satisfaction levels, sales performances and channel of distribution. This helps the firms is solving problems.

2. Formulating market strategies:

Today, markets are no more local. They have become global. Manufactures find it difficult to contact customers and control distribution channels. Competition is equally severe. The consumer needs are difficult to predict. Market segmentation is a complicated task in such wide markets. The marketing intelligence provided through marketing research not only helps in framing but also in implementing the market strategies.

3. Determining consumer needs and wants:

Marketing has become customer-centric. However, large-scale production needs intermediaries for mass distribution. Due to prevalence of multi channels of distribution, there is an information gap. Marketing research helps in collecting information on consumers from structured distribution research and helps in making marketing customer oriented.

4. For effective communication mix:

In an era of micro- rather than mass-marketing, communication plays a vital role. Marketing research uses promotional research to study media mix, advertising effectiveness and integrated communication tools. Research on such aspects will help in promoting effectively a company's product in the market.

5. Improving selling activities:

Marketing research is used to analyse and evaluate performances of a company within a market. It also studies effectiveness of a sales force. It helps in identifying sales territories. Such information helps the companies in identifying areas of shortcoming in sales. It also examines alternative methods for distribution of goods.

6. For sales forecasting:

The most challenging task for any production manager is to keep optimum levels of inventory. However, production is undertaken in anticipation of demand. Therefore, scientific forecast of sales is required. Marketing research helps in sales forecasting by using market share method, sales force estimate method and jury method. This can also help in fixing sales quotas and marketing plans.

7. To revitalize brands:

Marketing research is used to study and find out the existing brand position. It finds out the recall value of brands. It explores the possibilities of brand extension or prospects of changing existing brand names. The main purpose of marketing is to create brand loyalty. Marketing research helps in developing techniques to popularize and retain brand loyalty.

8. To facilitate smooth introduction of new products:

Marketing research helps in testing the new products in one or two markets on a small scale. This helps in finding out consumer response to new product and develop a suitable marketing mix. It reveals the problems of the customers regarding new products. Thus, it controls the risk involved in introducing a new product.

9. Determine export potentials:

The development in transport and communication has helped in globalization and digitalization of world trade. This has helped in boosting the growth of international markets. Marketing research helps in conducting market survey for export. It. collects information on marketing environment prevailing in a country. By collecting data on consumers from different countries, it indicates export potentials.

10. Managerial decision-making:

Marketing research plays a vital role in the decision-making processes by supplying relevant, up-to-date and accurate data to the decision-makers. Managers need up-to-date information to access customer needs and wants, market situation, technological change and extent of competition.

The 5 Step Marketing Research Process:
With constant change being the norm in marketing and business, one thing remains the same: the need for marketing research. Marketing research is a helpful tool for organizations to better identify marketing strategies and evaluate business decisions using data. Just as you wouldn't go on vacation without making any plans, you shouldn't design marketing strategies without backing them with research and data. In short, the marketing research process is the backbone of informed business and marketing decisions.

You might be surprised to hear that marketing research is one of the first things that organizations cut from their marketing budgets because of the high time (and sometimes monetary) investment. This is not the best decision, especially when your company is planning to launch a new product or venturing into a new market. As some savvy startups have learned, marketing research doesn't have to be expensive if you do it right and follow the right process.

Let's review best practices when going through the five-step marketing research process:

1. Define the Problem or Opportunity
The most important part of the marketing research process is defining the problem. In order to do any research and collect data, you have to know what you are trying to learn from the research. In marketing research, defining the problem you need to solve will determine what information you need and how you can get that information. This will help your organization clarify the overarching problem or opportunity, such as how to best address the loss of market share or how to launch a new product to a specific demographic.

Develop questions that will allow you to define your problem (or opportunity), and examine all potential causes so that the research can be whittled down to the information you actually need to solve that problem or determine what action to take regarding an opportunity. Oftentimes, these are questions about who your target market or ideal buyer persona is (for example: "What does our ideal customer look like?"). These might include questions about demographics, what their occupation is, what they like to do in their spare time—anything to help you get a clearer picture of who your ideal buyer persona is. Consider as many variables and potential causes as possible.

2. Develop Your Marketing Research Plan
After you've examined all potential causes of the problem and have used those questions to boil down exactly what you're trying to solve, it's time to build the research plan. Your research plan can be overwhelming to create because it can include any method that will help you answer the research problem or explore an opportunity identified in step one.

To help you develop the research plan, let's review a few techniques for conducting research:

- **Interview prospects and customers.** Oftentimes, you get the best feedback by using this tactic because you're going straight to the source. This might take the form of a focus group or one-on-one interviews. Use your defined research problem to help select the right people to interview.
- **Conduct a survey** using Survey Monkey or another tool.
- **Run user tests** on your website or landing page(s).

This is a cost-effective approach that can provide a lot of insight and data on how your customers or potential customers behave or respond to something, whether it's new messaging or branding or a modified product or service you are thinking about offering. Simple A/B tests can go a long way in discovering user behavior. Use heatmapping tools, such as Hotjar or Lucky Orange, and website analytics tools, such as Google Analytics or HubSpot analytics, to track results depending on what data you need to collect.

Oftentimes, we do all of this work and gather all of the data—only to realize that we didn't have to reinvent the wheel because someone had already run a similar, credible study or solved the same problem. That doesn't mean you don't need to do any research, but learning about what other organizations have done to solve a problem or seize an opportunity can help you tweak your research study and save you time when considering all of the research options. In marketing research, this is called secondary data because it has been collected by someone else, versus the primary data that you would collect through your own research study.

3. Collect Relevant Data and Information

In marketing research, most of the data you collect will be quantitative (numbers or data) versus qualitative, which is descriptive and observational. Ideally, you will gather a mix of the two types of data. For example, you might run an A/B test on your website to see if a new pricing tier would bring in more business. In that research study, you might also interview several customers about whether or not the new pricing tier would appeal to them. This way, you're receiving hard data and qualitative data that provide more color and insight.

When collecting data, make sure it's valid and unbiased. You should never ask a research interviewee, "You think that we should offer a higher pricing tier with additional services, correct?" This type of question is clearly designed to influence the way the person responds. Try asking both open-ended and closed-ended questions (for instance, a multiple-choice question asking what income range best describes you).

4. Analyze Data and Report Findings

Now that you've gathered all of the information you need, it's time for the fun part: analyzing the data. Although one piece of information or data might jump out at you, it's important to look for trends as opposed to specific pieces of information. As you're analyzing your data, don't try to find patterns based on your assumptions prior to collecting the data.

Sometimes, it's important to write up a summary of the study, including the process that you followed, the results, conclusions, and what steps you recommend taking based on those results.

Even if you don't need a formal marketing research report, be sure that you review the study and results so that you can articulate the recommended course of action. Sharing the charts and data you collected is pointless if it doesn't lead to action.

Was your hypothesis proven wrong? Great—that's why you do testing and don't run with assumptions when making decisions that could have a major impact on your organization. It's always better to take the results as they are than to twist the data to prove yourself right.

5. Put Your Research into Action

Your research is complete. It's time to present your findings and take action. Start developing your marketing strategies and campaigns. Put your findings to the test and get going! The biggest takeaway here is that, although this round of research is complete, it's not over.

The problems, business environment, and trends are constantly changing, which means that your research is never over. The trends you discovered through your research are evolving. You should be analyzing your data on a regular basis to see where you can improve. The more you know about your buyer personas, industry, and company, the more successful your marketing efforts and company will be. When you look at it that way, you should start to wonder why so many organizations don't budget time and resources for marketing research.

Of course, there is a lot more to the marketing research process than these five core steps, but these are enough to get you started. Good luck, and be sure to share any tips you have discovered for conducting marketing research!

Conclusion:

Marketing research is usually the first step in the marketing process, after ideas for products are conceived. Businesses conduct marketing research to obtain information from the marketplace. They use it to solve problems, obtain information on competitors and determine theneeds and wants of non-paying consumers and customers. Marketers then analyze the data and develop various marketing strategies. Coca Cola has remained successful by using market research by implementing surveys and over time some other types of market research as well to remain successful. In this paper, I have shared with you that any type of market research can be used but it is based on what the business need at the time. I hope this information has shown you how important market research is and what it has to offer.

TOURISM AND HOSPITALITY IN INDIA: CHALLENGES, POTENTIALS,POSSIBILITIES AND NEW DIMENSIONS

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ABSTRACT

Tourism and Hospitality Industry are the fastest growing and booming industries in the nation as well as in the world. Tourism industry is creating number of jobs for the youths as well as it is playing major role in the economy of the country. By tourism activities, the foreign exchanges takes places which helps in escalation of the GDP of the country. Tourism is the fastest growing economic activity in the many countries around the world. The tourism and hospitality industry helps in stimulating the development of basic infrastructure, contributes growth of domestic industries, attract foreign investments and facilities the transfer of modern technology and information. We know that tourism is present in every society and region of the world. For someone, it is life style and for someone it is career and ideology for remaining. Tourism also acts as a binding agent for the nation around the world. It caters to everyone whether it is single person or a group looking for fun (recreation, honeymoon), eternal peace (mediation), health benefits & medical etc). Now days tourism is flourishing as other industries around the world.This paper traces the problems and challenges of the country as well as the pitfalls in tourism planning in India. The tourism sector is facing challenges such as lack of good quality infrastructure, global concerns regarding health and safety of tourists, communication problem, begging, poverty, corruption, pollution, roughly attitude of locals and guides disparate passenger/road tax structures across various states and shortfall of adequately trained and skilled manpower. Collected efforts by all stakeholders such as the government agencies, private sector and the community at large are pertinent for sustainable development and maintenance of the travel and tourism sector in the country. My this studywill help in understanding the rich cultural diversity of the country and will provide glimpse of rural, tribes, folk, fairs & emerging trends of the tourism. Apart from this, the paper will unveil the scope and dimension of tourism through Govt. initiatives & policies to unbundle the today condition of potentiality of tourism industry.

Key words:*Tourism environment, resources, infrastructure, policies, new dimensions & potentiality of tourism industry and skill development*.

Tourism & Hospitality-an Introduction

Tourism and Hospitality are the growing industries in India with people from all over the world coming here to experience the country natural beauty and visit its diversestates and their different cultures and climates. Tourism & Hospitality industry are the largest service industry in India with a substantial contribution to the country's Gross Domestic Product and employment. Tourism has the capacity to transform the entire society and bring foreign wealth through the easiest way. Tourism is the major engine for the economic growth of the nation and earning avenue of the foreign currencies.

The tourism industry employs a large number of people, both skilled and unskilled. Hotels, travel agencies, transport including airlines benefit a lot from this industry. Certain places with less industrial activities have been converted into tourist hubs. Almost every state of India is a centre of attraction in terms of tourism activities point of view.

In India, tourism and hospitality industry is flourishing in fast pace and the most especially advertising has played a key role in promoting the key tourism spots of India. For example like Kerala has been portrayed as "God's own country", Rajasthan as "Incredible State of India" and Goa as "Go Goa" and so on.

Tourism offers enormous growth potential for India, opening it up for business, trade and capital investment, boosting job creation and entrepreneurship, as well as protecting and promoting our rich heritage and cultural values. With investments expected to rise by 4.8% in 2016 and by 6.3% p.a. thereafter till 2026, the tourism industry will create a multiplier effect on other sectors of the economy, thus truly adding 'Inclusiveness' to Incredible India.

Present Situation and Features of Tourism in India

Today tourism is the largest service industry in India, with a contribution of 6.23% to the national GDP and providing 8.78% of the total employment.India witnesses more than 5 million annual foreign tourist arrivals and 562 million domestic tourism visits. The tourism industry in India generated about US$100 billion in 2008 and that is expected to increase to US$275.5 billion by 2018 at a 9.4% annual growth rate. The Ministry of Tourism is the nodal agency for the development and promotion of tourism in India and maintains the ***"Incredible India"*** campaign.

According to World Travel and Tourism Council, India will be a tourism hotspot from 2009-2018, having the highest 10-year growth potential. As per the Travel and Tourism Competitiveness Report 2009 by the World Economic Forum, India is ranked 11th in the Asia Pacific region and 62nd overall, moving up three places on the list of the world's attractive destinations. It is ranked the 14th best tourist destination for its natural resources and 24th for its cultural resources, with many *World Heritage Sites*, both natural and cultural, rich fauna, and strong creative industries in the country. India also bagged 37th rank for its air transport network.

Year	Contribution of Tourism in GDP of the Country (%)			Contribution of Tourism in employment of the Country (%)		
2009-10	3.68	3.09	6.77	4.37	5.80	10.17
2010-11	3.67	3.09	6.76	4.63	6.15	10.78
2011-12	3.67	3.09	6.76	4.94	6.55	11.49
2012-13	3.74	3.14	6.88	5.31	7.05	12.36

Foreign Tourist ArrivalsinIndia

(In Million)
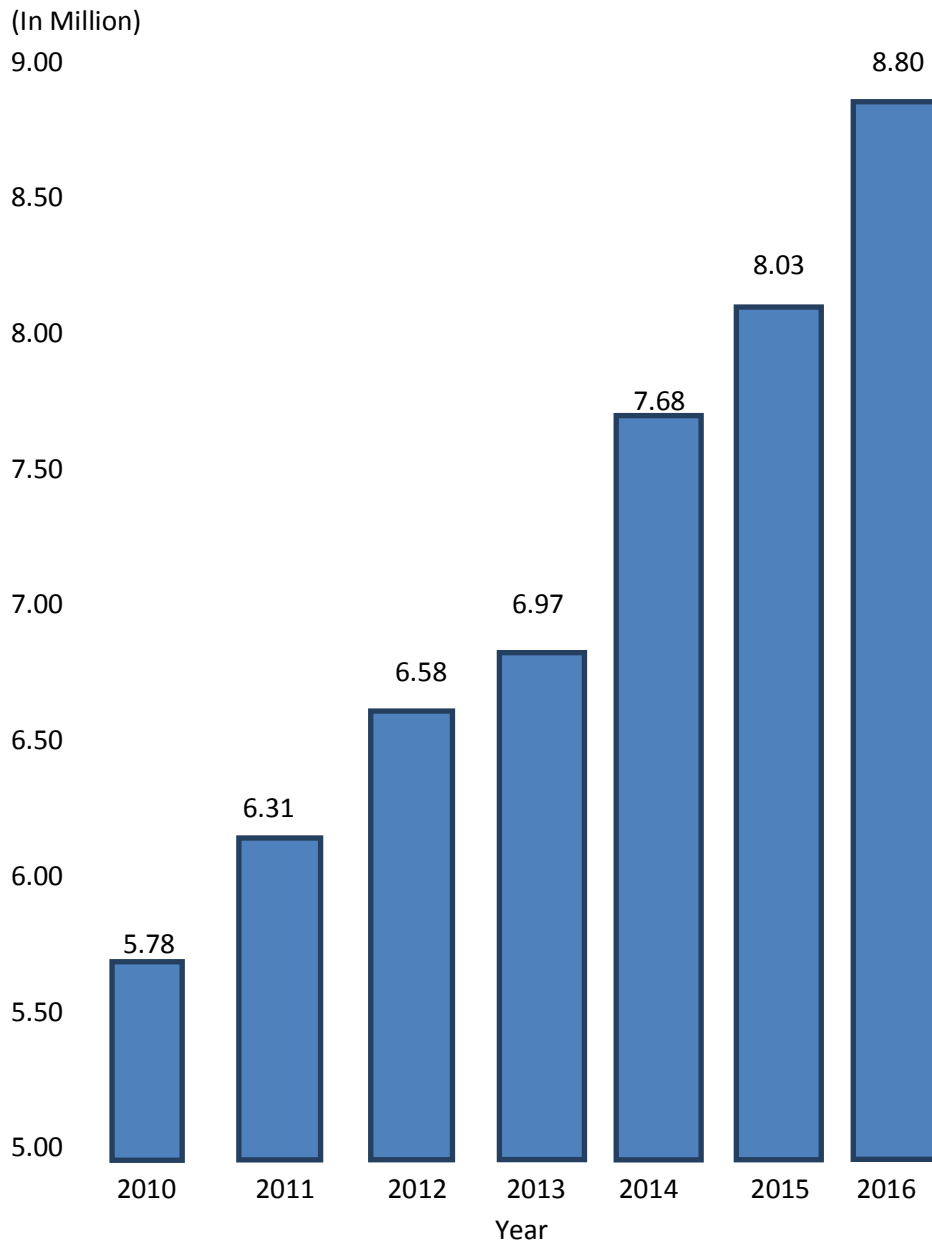
Rich Cultural Diversity of India:

Here is a brief overview of the culture of India.

Language:India has 28 states and seven territories. The Constitution of India officially recognizes 23 official languages. Many people living in India write in Devanagari script. In fact, it is a misconception that the majority of people in India speak Hindi. Sanskrit, an ancient Indo-European language usually referred to in action movies, came from Northern India. About 13 percent of Indians are Muslim, making

it one of the largest Islamic nations in the world. Christians and Sikhs make up a small percentage of the population, and there are even fewer Buddhists and Jains.

Food:Indian cuisine is influenced by many other countries. It is known for its large assortment of dishes and its liberal use of herbs and spices. Cooking styles vary from region to region.Wheat, Basmati rice and pulses with chana (Bengal gram) are important staples of the Indian diet. The food is rich with curries and spices, including ginger, coriander, cardamom, turmeric, dried hot peppers, and cinnamon, among others. Chutneys — thick condiments and spreads made from assorted fruits and vegetables such as tamarind and tomatoes and mint, cilantro and other herbs — are used generously in Indian cooking.

Architecture and Art:The most well-known example of Indian architecture is the TajMahal, built by Mughal emperor Shah Jahan to honor his third wife, MumtazMahal. It combines elements from Islamic, Persian, Ottoman Turkish and Indian architectural styles. India also has many ancient temples.India is well known for its film industry, which is often referred to as Bollywood. The country's movie history began in 1896 when the Lumière brothers demonstrated the art of cinema in Mumbai. The major classical dance traditions — BharataNatyam, Kathak, Odissi, Manipuri, Kuchipudi, Mohiniattam and Kathakali — draw on themes from mythology and literature and have rigid presentation rules.

Clothing**:** Indian clothing is closely identified with the colorful silk saris worn by many of the country's women. A traditional piece of clothing for men is the dhoti, an unstitched piece of cloth that is tied around the waist and legs. Men also wear a kurta, a loose shirt that is worn about knee-length. For special occasions, men wear a sherwani or achkan, which is a long coat that with a collar having no lapel. It is buttoned up to the collar and down to the knees.

Customs and celebrations**:** Diwali is the largest and most important holiday to India, according to National Geographic. It is a five-day festival known as the festival of lights because of the lights lit during the celebration to symbolize the inner light that protects them from spiritual darkness. Holi, the festival of colors, also called the festival of love, is popular in the spring.

Tourism Resources:

There are several types of tourism resources across the nation which makes India images shinning and attractive. Due to which, the foreigners gets fascinated towards the rich tourism resources available in India.

Natural Tourism Resources- includes mountains, planes of northern India, peninsular plateau, coastal planes, islands, water bodies likes rivers, lakes, wet lands, waterfalls, flora and Fauna, biosphere reserves, mangroves etc.

Popular land based tourist destinations-

Aguada, Agra, Almora, Anjuna, Araku Valley, Betalghat, Calungute, Chandawarietc.

Popular Water based tourist destinations-

Anjuna, AnsupaLake,BadhkhalLake, Balgai Beach, Balramgudi Beach, Chilika Lake, Dhableshwar, JuhuChaupati Beach, Kempty Falls, Jhona Water Falls, Kochuveli Beach etc.

Popular Air based tourist destinations-
Calungue, KatraVaishno Devi Helicopter Service,Majorada,Safdarjang Airport, Solang Valley etc.

Wild life Sanctuaries and National Parks-
AgatsyaVanam Biological Park, anna Wildlife Sanctuary, Bhirtarkanika National Park, Crocodile House, Hazaribagh Wildlife Sanctuary, Kangar Valley National Park, JaladparaWildlife Sanctuary, Koringa Bird Sanctuary, Dandeli Wild life Sanctuary, Namdapha National Park, Nagarhole National Park, Nandankanan Wildlife Sanctuary, Silent Valley National Park, Simlipal National Park, Sunderbans Tiger Sanctuary, Zoologicla Garden of India etc.

Cultural Resources-
Various styles of classical dance like Bharatanatyam, Kathak, Kathakali, Manipuri, Odissi, Kuchipudi, Mohiniattam , Bangra, gidda, Dandiya, Tamasha, Jumar, RasleelaKhoria, Bihu, Khayal, Kajri, Kolattam etc. of different states attracts the domestic travellers and foreigners. Further, the fairs and festivals of different states like KumbhMela, Deepawali, VasantPanchmi, Shivratri, Holi, Ramnavmi, Dusshera, Janmastami, Naga Panchmi, Rakshabandhan, Ganesh Chaturthi, Moharram, Shabh-e Barat, Ramzan, Bihu, Pongal are unique on their own style.

Tourism Infrastructure:

Tourism Infrastructure demands for goods and services, and the establishments which provide such services are considered as part of the tourism industry. Further, the tourism Infrastructure also includes establishments whose products are mainly sold to visitors, though they do not form a major share of touris**t** consumption. Several infrastructure sectors like power,telecommunication, water supply, roads and some production sectors like travel items, sports equipment, photographic materials, medicines and   cosmetics   are   included   in   this   categoryalong   with Tourism   Infrastructure. The infrastructure for tourism thus includes basic infrastructure components like airports, railways, roads, waterways, electricity, water supply, drainage,sewerage, solid waste disposal systems and services. Moreover, facilities like accommodation, restaurants, recreational facilities and shopping facilities also comes under the ambit of Tourism Infrastructure.

The basic requirements for the development of Tourism Infrastructure are-

Accommodation   -

- Forest lodges.
- Tented accommodation.
- Tourist complexes / tourist lodges.
- Wayside amenities.
- Restaurants.
- Tourist reception centers.
- Pilgrim sheds / dormitories, etc. at pilgrimage centers.

Tourist transport–

- Mini-buses, jeeps, elephants, etc. for wild life viewing.
- Cruise boats, ferry launchers, etc. for water transport.
- Tourist coaches in selected circuits.
- Special tourist trains.

Initiatives undertaken by Govt. of India in reference to Tourism Policy 2016:

A. The 'e-visa' facility i.e 'e- Tourist Visa', e – Business Visa' and 'e – Medical Visa'. 'E –Visa has been extended to the national of 161 countries.

B.   For providing information relating to Travel & Tourism in India to the domestic and International tourists/visitors and for assisting them with advice while travelling in India, a 24x7 Toll Free helpline 18000111363 is being run by the Ministry of Tourism. The calls made by tourists (both international and domestic) while in India will be free of charge.

C.   For imparting tourism and hospitality education, various new Institutes of Hotel Management (IHMs) and Food Craft Institutes (FCIs) have been opened. Further, the Tourism 7 hopsitality subject has been started in the Secondary andSenior Secondary levels.

D.   The Ministry of Tourism has set up theIndian Culinary Institute (ICI) at Tirupati,Andhra Pradesh. The first of its kind in India,the Institute has commenced its academic session from August, 2016. The Ministry is also expanding the ICI, by opening its Northern Chapter at Noida which has beensanctioned at a total cost of Rs.98.50 crore. Rs.65 crorehave already been released bythe Ministry for the project.

E.   The Ministry of Tourism organizes Bharat Parv as part of the Republic Day and Independence Day celebrations with theobjective to promote national integrity and to showcase cultural and culinary diversityto the people of our nation. 2 Bharat Parvs, from 12th to 18th August, 2016 and from26th to 31st January, 2017 were organized during 2016 -17.

F.   A quarterly News letter "Tourism News letter" highlighting the activities and achievements of the Ministry of tourism hasbeen published beginning from the quarter ending of 30th September, 2016 onwards.

G.   For creation of tourism infrastructure, the Ministry of Tourism has two major plan schemes viz. SwadeshDarshanIntegrated Development of Theme-Based Tourist Circuits and PRASAD-PilgrimageRejuvenation and Spiritual Augmentation Drive for development of tourisminfrastructure in the country including historical places and heritage cities.

H.   SwadeshDarshan scheme has a vision to develop theme based tourist circuits on the principles of high tourist value,competitiveness and sustainability in an integrated manner by synergizing effortsto focus on needs and concerns of all stakeholders to enrich tourist experienceand enhance employment opportunities. Under the scheme thirteen thematic circuitshave been identified for development, namely: North-East India Circuit, BuddhistCircuit, Himalayan Circuit, Coastal Circuit, Krishna Circuit, Desert Circuit, TribalCircuit, Eco Circuit, Wildlife Circuit, Rural Circuit, Spiritual Circuit, Ramayana Circuit& Heritage Circuit.

I.   Under PRASAD scheme, 25 sites of religious significance have been identified for development in India namely Amaravati(Andhra Pradesh), Amritsar (Punjab), Ajmer (Rajasthan), Ayodhya (Uttar Pradesh), Badrinath (Uttarakhand), Dwarka (Gujarat), Deoghar (Jharkhand), Belur (WestBengal), Gaya (Bihar) , Guruvayoor (Kerala), Hazratbal (Jammu & Kashmir), Kamakhya(Assam), Kanchipuram (Tamil Nadu), Katra (Jammu & Kashmir), Kedarnath(Uttarakhand), Mathura (Uttar Pradesh), Patna (Bihar), Puri (Odisha), Srisailam(Andhra Pradesh), Somnath (Gujarat), Tirupati (Andhra Pradesh), Trimbakeshwar(Maharashtra), Ujjain (Madhya Pradesh), Varanasi (Uttar Pradesh) and Vellankani(Tamil Nadu).

J.The Ministry of Tourism has launched an initiative for providing pre-loaded SimCards to foreign tourists arriving in India on e-Visa. This initiative has been launchedon 15th February 2017 in association with Bharat Sanchar Nigam Ltd., (BSNL),wherein BSNL would distribute pre-loaded SIM Cards to foreign tourists on e-Visa.

New dimensions and potential of tourism industry:

As the tourism industry is rapidly expanding. Number of hotels, resorts, lodges, guest houses, amusement parks, water parks are coming everyday which arebecoming the source of entertainment and fun for all age people.

The emerging dimensions of tourism are enumerated as below:

Niche Tourism: The term 'niche refers to an optimum location, which an organism can exploit in terms of resources in the presence of its competitors. It is easy to see the analogy to the world of business and so we may talk, for instance, of a company finding its particular or appropriate niche. Indeed, the use of the term 'niche' is part of a wider usage of biological/ecological metaphors that informs business theory and practice.

Ecotourism: Ecotourism is one among the fastest growing segment of tourism Industry. Ecotourism is responsible travel to natural areas that conserves the environment and improves the well being of local people.

 Health Tourism : Medical Tourism can be broadly defined as a provision of cost effective private medical care in collaboration with the tourism industry for patients needing surgical and other forms of specialised treatment. The process is being facilitated by the Corporate Sector involved in medical care as well as as the tourism industry both private and public.

Spiritual Tourism: The essence of spiritual tourism is inner feeling through love. Love should not be rationed on the basis of caste, creed and economic status or intellectual attainment of the recipient. Religions come into existence for the purpose of regulating human life; what are common to all of them are the principles of love. Thus through religious tourism there is a sincere effort to bring better understanding among various communities, nations and thus foster global unity.

Adventure Tourism: It is exploration or travel to remote or exotic areas where the traveller expects the unexpected. Mountaineering, trekking, river rafting, forest tours, paragliding, bunjee jumping are some of the activities involved in Adventure tourism.

Agritourism: It is spending time on a farm or a ranch. This may include the chance to help with farming and rtanching tasks during the visit. Agritourism is gaining popularity in agriculturally rich countries. Wine tourism is agood example of this where tourist spends time in vineyards and experience wine making which is popular in counties like Australia, Italy, Portugal, Spain and North America.

Beach Tourism: In dia has a beautiful coastline spread over approximately 7000Kms. In the lap of this coastlines there are beautiful natural and manmade beaches which seems heavenly for water loving tourists.. All those who are more adventurous and yearn for challenging activities the beaches offer a variety of fun such as swimming along with the waves of the ocean.

Culinary Tourism: Also known as Gourmet Tourism, Culinary tourism, According to the International Culinary Tourism Association, it is defined as the pursuit of unique and memorable eating and drinking experiences.

IMPACT OF TOURISM IN INDIA

Tourism industry in India has several positive and negative impacts on the economy and society. These impacts are highlighted below.

POSITIVE IMPACTS

1. Generating Income and Employment: Tourism in India has emerged as an instrument of income and employment generation, poverty alleviation and sustainable human development. It contributes 6.23% to the national GDP and 8.78% of the total employment in India. Almost 20 million people are now working in the India's tourism industry.

2. Source of Foreign Exchange Earnings: Tourism is an important source of foreign exchange earnings in India. The tourism industry in India generated about US$100 billion in 2008 and that is expected to increase to US$275.5 billion by 2018 at a 9.4% annual growth rate.

3. Preservation of National Heritage and Environment: Tourism helps preserve several places which are of historical importance by declaring them as heritage sites. For instance, the TajMahal, the QutabMinar, Ajanta and Ellora temples, etc, would have been decayed and destroyed had it not been for the efforts taken by Tourism Department to preserve them.

4. Developing Infrastructure: Tourism tends to encourage the development of multiple-use infrastructure that benefits the host community, including various means of transports, health care facilities, and sports centers, in addition to the hotels and high-end restaurants that cater to foreign visitors. The development of infrastructure has in turn induced the development of other directly productive activities.

NEGATIVE IMPACTS

 1. Undesirable Social and Cultural Change: Tourism sometimes led to the destruction of the social fabric of a community. The more tourists coming into a place, the more the perceived risk of that place losing its identity. A good example is Goa.

2. Increase Tension and Hostility: Tourism can increase tension, hostility, and suspicion between the tourists and the local communities when there is no respect and understanding for each other's culture and way of life. This may further lead to violence and other crimes committed against the tourists. The recent crime committed against Russian tourist in Goa is a case in point.

3. Creating a Sense of Antipathy: Tourism brought little benefit to the local community. In most all-inclusive package tours more than 80% of travelers' fees go to the airlines, hotels and other international companies, not to local businessmen and workers. Moreover, large hotel chain restaurants often import food to satisfy foreign visitors and rarely employ local staff for senior management positions, preventing local farmers and workers from reaping the benefit of their presence. This has often created a sense of antipathy towards the tourists and the government.

4. Adverse Effects on Environment and Ecology: One of the most important adverse effects of tourism on the environment is increased pressure on the carrying capacity of the ecosystem in each tourist locality. Increased transport and construction activities led to large scale deforestation and destabilisation of natural landforms, while increased tourist flow led to increase in solid waste dumping as well as depletion of water and fuel resources. Flow of tourists to ecologically sensitive areas resulted in destruction of rare and endangered species due to trampling, killing, disturbance of breeding habitats.

CONCLUSION

Tourism industry in India is growing and it has vast potential for generating employment and earning large amount of foreign exchange besides giving a fillip to the country's overall economic and social development. But much more remains to be done. Eco-tourism needs to be promoted so that tourism in India helps in preserving and sustaining the diversity of the India's natural and cultural environments. Health tourism in India is promoted as high-tech healing destinations, which provide world-class treatment at low cost, incorporating the Indian system of medicine ayurveda, naturopathy, unani, sidha and allopathy. India is the seat of spiritualism. It is the confluence of different religions: Hinduism Sikhism, Islam, Christianity, and Jainism, etc. Sustainable tourism is a new concept, which says that the tourism development should meet the needs of the present without compromising the ability of future

generation to meet their needs.Tourism in India should be developed in such a way that it accommodates and entertains visitors in a way that is minimally intrusive or destructive to the environment and sustains & supports the native cultures in the locations it is operating in. Moreover, since tourism is a multi-dimensional activity, and basically a service industry, it would be necessary that all wings of the Central and State governments, private sector and voluntary organisations become active partners in the endeavour to attain sustainable growth in tourism if India is to become a world player in the tourism industry.

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A Study of Marketing factors influencing on Consumers Buying Behavior : With special reference to shopping Malls in Pune city

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Abstract :

To understand the various aspects of marketing, it is essential to understand buying behavior of consumer. Consumer behavior is the study of when, why, how and where consumer do or do not buy a product. It includes psychological, sociological, and social anthropology and economic elements. Through the present study, an attempt has been made to understand consumers interest to visit shopping mall, influencing marketing and personal factor concerned with their buying decision. It also tries to find out the various departments to which consumers are more satisfied.

Key words : Consumers buying behavior, Shopping Malls, Influencible Marketing and Personel factors.

I) **Introduction :**

To understand the buyer and to create a consumer through this understanding is the main purpose of buyer behavior studies. What motivates the consumer to buy in shopping malls ? Why does they shift their preference from small retail shop to big shopping malls ? What are the marketing related factors and personal factors, influencing on their buying decision ? are some of the questions that are of perennial interest of the marketing man. Because, it is around these questions that the product and promotion strategies of the marketing man ultimately revolves. In all the marketing strategies and plans, marketing experts makes assumptions as to how the buyer would behave and respond to his marketing programs. Knowledge of the buyer and his buying motives and buying habits is a basic requirement for the marketing experts.

To understand marketing, one must understand buyer behavior, for marketing success or failure depends on target consumer individual and group reactions expressed in the form of buying pattern. Therefore in order to undertake the marketing programme among various segments of consumers, the marketing man must find as to what factors influence the buying decision ? An attempt has also been made to focus on these factors through the present study in Pune city.

II) **Literature Review:**

1) A. C. Narhari and D. Kuvad, (2017) have attempted to focused on the buying behavior of consumer who visit shopping malls, and identified to gender differences in term of buying behavior. Through the study author have found that, the consumers are very happy with overall experience of purchasing in shopping malls.   Authors have also found that, there are no

predominant differences between male and female buyers in their shopping experiences, choices and decision of buying. Through the study author have also pointed out that the strengthened spending capacities of upper and middle class households.

2) R. S. Sharma, (2012) has accessed the overall customer satisfaction, and analyzed the response of consumers with regard to the availability and quality of products and services rendered at shopping malls. Author has also accessed the comfort level of the consumers towards shopping malls. Author has further stated that, shopping malls not only cater to the product needs of the consumers, but also a source of entertainment and recreation.

3) S. Thomas and Bharti Pathak, (2012) have examined the attractiveness factors of shopping malls from shoppers perspective, based on the survey of urban shoppers. Through the study author have proposes to study the shopping mall attractiveness wherein the attempt is to study the behavior and attitude of the shoppers towards malls. Authors have arrived at the characteristics of a shopping mall that consumers consider while visiting the mall which are overall attractiveness.

4) K. A. Ratnakumari and B. Pradeep Kumar, (2017) have looks into the factors that impact on the buying behavior of consumers who visit and purchase from shopping malls. Through the study author have observed that, in shopping malls the buying behavior of customers is impacted by economic and noneconomic factors. Authors have observed that, among the economic factors, offering discounts in the major factor that impacts the buying behavior of the consumers. Author have also pointed out that, combo offers also play an important role in deciding the buying behavior of consumers at the shopping malls.

5) G. C. Sekhar and K. Srinivas, (2016) have focused on the various marketing strategies of retail store for attracting consumers, and satisfaction level of consumers. Authors have also through a light on the main factors that influence buying decision process. Through the study author have assessed the overall consumer satisfaction, their response with regard to the availability and quality of product and services rendered by the shopping malls. Author have concluded that, big shopping malls has had a great influence on the middle class families, the prices, quality and sales strategy has helped in getting the middle income groups getting attracted towards big shopping malls.

6)

III) **Importance of the study :**

Today, culture of shopping malls is growing in various cities in India. Due to market competition, these shopping malls are facing various problems and challenges to retain their consumers for a longer period. Consumers are also experiencing a new kind of shopping facility in their cities, which is quite distinctive to that of traditional shopping facility. There is a study dearth on the topic related to shopping malls and consumers buying behavior, especially in Pune city. Pune city being a IT Hub, educational center, and metropolitan city, there is a necessity to focus on this kind of study. Therefore, the present study aims at analyzing the purchasing behavior of consumers who are purchasing in shopping malls.

IV) **Objectives of the Study**: The present study is planned with following objectives-

1)   To understand the consumers interest to visit shopping malls.

2)   To focus on the market related factors influencing on consumers buying decision.

3)   To focus on the personal factors influencing on consumers buying decision.

4)   To understand other reasons of consumers preference to shopping malls.

5)   To find out the major departments in shopping malls to which consumers are more satisfied.

V)   **Research Methodology:**

This present study is descriptive in nature and based on the primary data collected from 120 consumers, purchasing in shopping malls situated in Pune city. The secondary data have been collected from various national and international journals, periodicals, etc. and published books. The surveys method has been followed to explore the facts, as the study has to explore the buying behavior of shopping malls consumers. All the primary information is presented in a table from by using percentage method.

VI)   **Selection of Samples :**

The following table indicates the number of respondents (consumers) selected from the various suburbs of Pune city.

Suburbs	No. of Respondents
Kothrud	35
Hadapsar	31
Sinhagad Road area	25
Bibwewadi/Dhankawadi	29
TOTAL	120

Convenient sampling method has been adopted for the purpose of sample selection.

VII)   **Scope and limitation of the Study** :

i)   This present study deals with the consumers purchasing in shopping malls in the selected four suburbs of Pune city only.

ii)   The scope of the study is restricted to explore the factors influencing on the buying decision.

iii) Functional scope is restricted to concerned objectives only.

iv)   Regional scope is restricted to Pune city only.

v)

VIII)   **Result and Discussion:**

Table No.1

Consumers Interest to visit Shopping Malls.

Interest Factors	No. of Respondents	Percentage (%)
Convenient Place for Shopping	13	11%
Reasonable Prices of Product	24	20%
Discounted and Other Attractive Schemes	19	16%
Quality of the Product	17	14%
All the Above	47	39%
Total	120	100%

From the above table, it can be observed that, majority of the respondents (39%) are interested in visiting shopping malls due to various aspects, such as convenient place for shopping, reasonable price rates, discounts and other attractive schemes promoted by mall shoppers, quality of products.   The other isolated interest factors are also attracted good proportion of selected respondents.

Table No.2
Market Related Factors influencing on consumers buying Decision.

Market Related Factors	No. of Respondents	Percentage (%)
Price of the Product	32	27%
Brand name of Product	16	13%
Quality and composition of Product	12	10%
Impact of Advertisement	11	9%
All the above	49	41%
Total	120	100%

It can be noted from the above table, price of the product (27%) brand name of the product (13%) and quality/composition of product (10%) and impact of advertisement(9%) are the most influenciable market related factor affecting on the buying decision of the consumers. Majority of the respondent (41%) have opined that all these factors are equally influencing on the buying decision of consumers. It shows that not any single market related factor impacting on the buying decision of consumers. This is due to availability of variety of products in the shopping malls, for consumer's choice. Apart from this, today consumer is also aware about the prices, quality/composition and brand name of the product.

Table No.3
Personal Factors influencing on Consumers Buying Decision.

Personal Factors	No. of Respondents	Percentage (%)
Age	08	07%
Occupation	10	08%
Income	26	22%
Life Style	11	09%
Personality & Self Concept	18	15%
All the above	47	39%
Total	120	100%

From the above table we come to know that, 7% of the respondents have stated that, age factor is influencible personal factor which is directly affected on the buying decision. Tastes in food, cloths, and household appliances are often related to the age of individual. Consumers change their likes and dislikes as per their age. In the opinion of 8% respondents, occupation of consumer affects the goods and services bought. It means, blue collar employees tend to purchase more rugged work cloths, where as white collar

employees purchase business suits. It is obvious, income level of the consumer effects on the buying decision stated by 22% respondents. Life style or pattern of living of a person is also directly affected on the buying decision. Life style involves consumers work hobbies, shopping habits, interest in food, fashion, recreation and their personal opinions regarding particular product or service.

In the opinion of 15% respondents, personality and self-concept influences on the consumers buying decision. Personality and self-concept refers to the unique psychological features that lead to relatively consistent and lasting responses to consumers own environment. In the opinion of 39% respondents, all the above stated personal factors are directly or indirectly affecting on the buying decision of the consumers.

Table No.4

Reasons for Preference to Shopping Malls.

Reasons	No. of Respondents	Percentage (%)
Availability of Entertainment Venus and Restaurants	08	07%
Availability of various Items under One Roof	22	18%
Quality of Product	28	23%
Availability of Variety in Products	20	17%
All the Above Problems	42	35%
Total	120	100%

According to 7% respondents, availability of entertainment venues and restaurants under one roof is the main reason for giving preferences to the shopping malls. According to 18% respondents, availability of various items under one roof is the main reasons, in the opinion of 23% respondents, quality of products is main reason and 17% of respondents have opined that, availability of huge variety in a product is the main reason and majority of the respondents (35%) have stated for their buying purpose.

Table No.5

Satisfied Consumers with Various Departments (Multiple Response)

Departments	No. of Respondents	Percentage (%)
Electronic Home Appliances Dept.	120	100%
Ready Made Garment Dept.	89	074%
Cosmetic Dept.	97	080%
Grocery Dept.	100	083%
Utensils Dept.	87	073%

The above table indicates the proportion of satisfied consumers with various departments in the shopping malls. Almost all the respondents responded multiply in this regard. Electronic home appliances department seems like satisfying majority of respondents (100%) followed by 83% respondents satisfied with Grocery department, 80% respondents satisfied with cosmetic department, 74% respondents satisfied with readymade garments department and 73% respondents are satisfied with Utensils.

IX)   **Major findings of the Study**:

1) It is noted from the analysis that, majority of the respondents are having interest to visit shopping malls because of convenient place, reasonable prices, discounts and other attracting schemes and quality of products.

2) Majority of the respondents are influenced by several market related factors while purchasing any branded product in shopping malls.

3) There are also many personal factors which are influencing on the buying decision of consumers.

4) It is found that majority of the respondents are giving preference to the shopping malls for purchasing due to availability of entertainment venues, restaurants, huge variety of products, under one roof.

5) It is found that, almost all the departments in shopping malls satisfy to the maximum number of respondents.

X) **Conclusion :**

To conclude, it may be said that, in shopping malls the buying decision of consumers is influenced by marketing related factors and personal factors. Both factors are the major factors influence the buying behavior of consumers. It is observed the fact that, shopping malls have created a specific pattern of purchasing behavior among the consumers. Several marketing and personal influencing factors have come to occupy an important place in the demand function pertaining to those who visit shopping malls. Theories of consumers buying behavior required to be accommodative of change in the marketing process.

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