"APPLICATION OF ANTS BASED TECHNIQUES FOR TEAM BUILDING IN THE MODERN ORGANISATIONS – A CONCEPTUAL FRAMEWORK"

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Abstract

Today's global environment has become intensely competitive for business organizations. Only the organizations which are adaptable and responsive to the changes will be able to survive and succeed. Innovative techniques are required to build responsive organization. One of the building blocks of a responsive organization is adaptable work teams. The performance of work team depends upon its Synergy, efficiency and adaptability. Today's organizational teams are not consistent, effective, and responsive enough to changes for several reasons. Nature offers us an invaluable wisdom learned and tested over the course of millions of years. One such area for learning from nature is to look at nature's most successful living biological teams like Ants which can provide useful guidelines on how teams need to operate to become truly successful, consistent and responsive to the changing environment. Although there are several approaches to build a team, there exists a need for new techniques to build and sustain a more cohesive, cooperative, committed and adaptable team with higher synergy and performance. Nature provides an insight to deal with such team management situations. This study focuses on one of the natures most successful ants' teams because of their unique social organization and ability to work together cohesively. By studying ants' organization we are actually learning the wisdom of the nature. This insight could be applied and adapted in organizations to build more effective work teams.

Key words: Ants, Team, Organization, Adaptability, Behavioral Elasticity, Division of Labor, caste, structure

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INTRODUCTION

Man is learning many things from nature for survival. Man's biggest genetic gift is his vast capacity for learning from his environment (R Mathur et al, 2008). One way in which humans have always endeavoured to learn, when confronted by barriers to progress, is to see what nature can enlighten us (Meredith Belbin, 1998). Nature offers us an invaluable wisdom learned and tested over the course of millions of years. Through evolution process biological teams like ants, have learnt how to live together successfully in colonies and survive in diverse habitat. The most inspiring aspect of ants is their cooperative and collective behavior and their ability to work with amazing efficiency. The outcome of this collective behavior is that all the group tasks like nest building, food foraging, brood care and other colony activities are performed in an organized way and efficiently without the supervision. Their success is attributable to their efficient group behavior and design of social organization.

The one aspect of social design where ant colonies are known to show great resilience is through the measured response of their workers occurs through behavioral elasticity. Ants respond to sudden catastrophes based on mutual monitoring and exhibiting flexibility in carrying out additional tasks in the demanding situation. Colonies in nature, given their long lives, will be commonly subject to catastrophes like removal of part of their foraging workforce by predators or other phenomenon like floods. This sort of behavior among ants to respond to the changing environment effectively and successfully provides a new insight about how human based organizations and work teams can sustain the rapidly changing business environment. The ant colonies in several respects resemble to human based organizations (Sudd and Franks, 1987).

Organizational Teams

Teams are common in our business organizations. Various types of teams have come to stay, like, Self-managed work teams, Problem solving teams, Management teams and Virtual teams and these teams can do a variety of tasks (Stephen R Robbins, 2005). Teams are used for multiple organizational functions to address small and specific organizational task to complex and self-managed work Teams. There are many benefits to using teams in workplace. The Key benefits of work teams include shared goal and responsibilities, innovative and effective problem solving, better decision making, improved communication, better social relations and use of resources,

higher productivity and better quality goods and services. Studies reveal that while teams achieve good outcomes, they often fail for one reason or another. As a result teams are sometimes successful and sometimes unsuccessful. Hence the performance is not consistent. The failure rate for work teams is high. The studies indicate that 80 percent of Fortune 500 Companies have half their employees on teams. Many of these teams are of the self-directed nature with estimates of the failure rate at around 50 percent (Keith Denton, 2007). Only a third of change initiatives achieve their objectives and 74% of projects are unsuccessful observes (Ken Thompson, 2008). Academics and management consultants quote team failure rate of 50 percent, and in that half of work teams fail to achieve their goals (Todd Harris, 2008). Roger Thorson (2005) observes that the failure rate of team change efforts is 55 percent. One of the key factors that improve the team performance is by using effective teambuilding methods. Studies suggest that many teambuilding interventions fail to build an effective team (Steven L McShane et al, 2011). This calls for exploring new teambuilding techniques to build more consistent and successful teams. One way in which humans have always endeavored to learn, when confronted with barriers, is to see what nature can tell us. This necessitates looking innovatively for solutions to avoid team failures and make responsive and adaptable to become more successful.

STRUCTURE OF ANT SOCIETY

Self-organization – social insects like ants exhibit many interesting complex behaviors, such as emergent properties from local interactions. The emergent collective behavior is the outcome of a process of self-organization, in which ants are engaged through repeated actions and interactions with their evolving environment. A complex collective behavior rises from simple local individual interactions. Self-organization is defined as a process in which activities are neither centrally controlled or locally supervised (Eric Bonabeau and Christopher Meyer, 2001). As defined by Camazine et al (2001), self-organization is a process in which pattern at the global level of a system emerges solely from numerous interactions among the lower-level components of the system. Moreover, the rules specifying interactions among the system's components are executed using only local information, without reference to the global pattern. These interactions are often indirect and the system dynamics modifies the environment, and the modifications of the environment influence in turn the system, but without disturbing the internal mechanism leading to the organization. Well known examples of self-organization in ants are – organize themselves

to perform activities such as food foraging, nest building or sorting of broods or bodies. Foraging is the collective behavior through which ants collect food by exploring their environment. During the foraging process, ants leave their nest and explore their environment through a random path. When an ant finds a source of food, it carries a piece of it and returns back to the nest, by laying trails of pheromone along its route. This chemical substance persists in the environment for a particular amount of time before it evaporates. When other ants encounter a trail of pheromone, while exploring the environment, they are influenced to follow the trail until the food source, and enforce in their coming back to the nest the initial trials by depositing additional amounts of pheromone, The more a trail is followed, the more it is enforced and has a chance of being followed by other ants at later point of time. The pheromonal information deposited by insects constitutes an indirect communication means through their environment. That is, self-organized trail laying by individual ants during food foraging is a way of modifying the environment to communicate with the nest mates that follow such trails. Other examples of self-organization in ants include collective sorting of broods (eggs, larvae and cocoons) without having a particular ant knowing and applying the sorting algorithm. Ants form piles of items such as broods or bodies or grains of sand. There again ants deposit items at initially random locations. When other ants perceive deposited items, they are stimulated to deposit items next to them, being this type of cemetery clustering organization and brood sorting a type of self-organization and adaptive behavior. Self-organization in ants relies on an underlying mechanism, the mechanism of stigmergy, first introduced by Grasse in 1959 (Giovanna Di Marzo Serugendo et al).

IMPORTANCE OF THE STUDY

The organizations are constantly being confronted with new problems and changes in the environment, both internal and external. The organizations which are flexible and responsive to these changes consistently and effectively will only be successful. Organizations need to adopt innovative techniques to meet the changes successfully. One of the building blocks of a responsive and flexible organization is high performing and adaptable work teams. Today the organizational teams are not always consistent and successful. . Also, it is becoming difficult for a team to adapt itself to the changing external environment. These issues have an impact on the overall performance and effectiveness of the team and the organization as well. In order to build

more responsive and adaptable teams to overcome challenges this study focuses on natures most successful and efficient teams. The ants organization represents the pinnacle of social evolution and is highly adaptive with their colony resembling similar to human organizations. It is the nature that has made them successful and adaptable to environment through evolution. The insight of ants flexible organization can be used as guidelines to transform the modern organizational teams to become more responsive and adaptable.

STATEMENT OF THE PROBLEM

The effectiveness and efficiency of the team depends on the synergy. If the coordination and cooperation is high, the synergy level is high, if it is less the synergy is less. This affects the productivity and effectiveness of the team.

Today, the organizational teams are sometimes successful and sometimes not successful. There is no consistency in their performance due to various dynamic factors like organizational, social, technological and others on the functioning of the team. As a result, organizational teams are confronted with several problems like, lack of cohesiveness, co-ordination, information, communication, cooperative learning, conflicts, turnover, rewards, recognition, motivational and leadership issues. Also, it is becoming difficult for a team to adapt itself to the changing external environment. These issues have an impact on the overall performance and effectiveness of the team and the organization as well.

In order to address the team issues and to build more cohesive, mutually supportive, adaptive and committed team with high standards of performance the present study focuses on natures most successful and efficient team like, ants, as their organization represents the pinnacle of social evolution in animals with their colony resembling similar to human organizations.

OBJECTIVES

- To study the Ants team building behavior relevant to the adaptability and responsiveness.
- To explore the application of these concepts to build more responsive and adaptable work teams in the modern organization.

HYPOTHESES

The present study relied on the following conjectures or the tentative statements, which form the hypotheses of the study

H_0: The organizational teams are not confronted with problems and hence there is no impact on team synergy and effectiveness.

H_I: The organizational teams are confronted with problems and hence there is impact on team synergy and effectiveness

H_0: There is no impact of selective Ants based technique on the team synergy.

H_I: There is impact of selective ants based technique on the team synergy.

Methodology

The research approach is to extract the relevant concepts of building responsive and flexible organization team behavior from ants organization based on the existing literature and explore the application of the same in the work teams to make more consistent challenges.

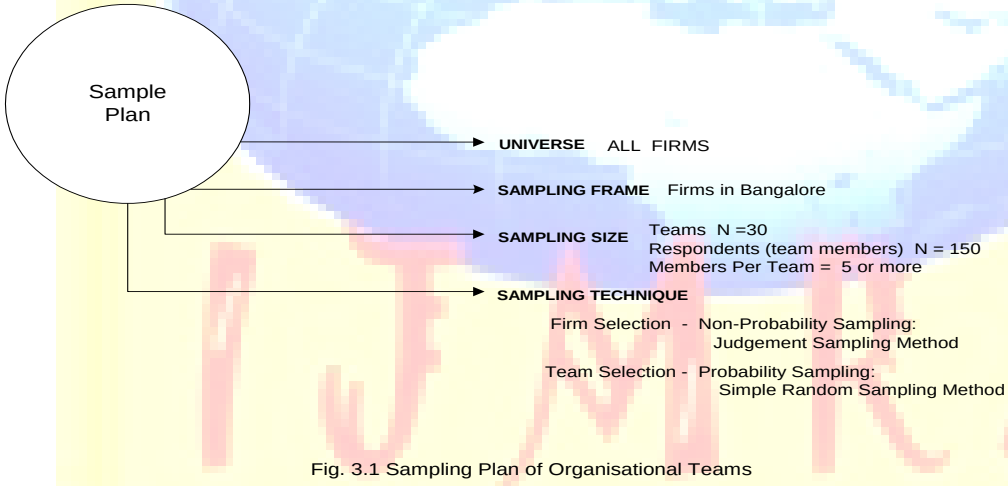


Fig. 3.1 Sampling Plan of Organisational Teams

Sampling Method

Non random sampling method is used for a firm for an organization company selection. The sample unit selection is made by Judgment sampling. This method is adopted as it is considered and believed most appropriate for the study. The team's selection in a firm is based on simple random sampling technique.

Sample Size

The teams for the study are selected from the Bangalore region. Thirty teams are selected. Each team consists of atleast 5 respondents (team members), hence there will be a total of 150 respondents (team members).

DATA ANALYSIS

The researcher aims to apply various statistical tools techniques for the purpose of drawing inferences and valid findings some the techniques contemplated to use are given bellow.

- Descriptive
- Percentages
- Chi-Square test
- Mean

REVIEW OF LITERATURE

A Study of the Ants organization and traits especially related to its adaptability and robust structure was taken up to get insights. It provides us with new technique to transform such insight in organizational work teams to make work teams more responsive and adaptable. Literature in the form of books, articles, reports, journals, dissertation and websites have been referred for acquiring insight on the subject.

John H Sudd and Nigel R Franks (1987) explain about the various tasks performed in ant colony and the method of task allocation and how it changes through the life of the workers in ant colony. In a colony having single worker caste, the different individuals have different roles at different times in their lives. Such age-based differences in behavior are called *temporal polytheism.* There are two hypothesis referring to how the task allocation occurs in single worker caste colonies. These hypothesis are referred to as *Continuous caste system* and *Discrete caste system.* In the Continuous caste system task allocation continuously changes through the life of a worker and there is no association or grouping of related tasks and hence there are no distinct roles. Tasks are not grouped into sets for each age class and a worker will be probably able to do many tasks in each age class. Hence there is flexibility in continuous temporal division of labour system. In the Discrete caste system there is distinct changes in task allocation with respect to age. Certain related tasks are grouped as a set and these tasks are predominantly performed by

certain age class and there is a distinct role for each age class. In this system worker can move from one task to another quickly within task repertoire once a given task is completed. The discrete temporal division of labour system contributes to efficient colony-factory system.

Raghavendra Gadagkar (2011) states that ants, bees and other social insects organize themselves into colonies or very sophisticated societies that are parallel and sometimes surpass human societies in their social organization, in their social integration, in communication, in division of labor and most importantly in the way in which they tread a balance between conflict and cooperation in the colony. Some of his findings include that the presence of queen will suppress the worker reproduction, and worker themselves regulate each other's work in a decentralized, self-organized manner, irrespective of whether the queen is present or not.

Bert Holldobler and Edward O. Wilson (1990) points out that the key principle of caste evolution is the adaptive nature of colony demography. The workers are for the most part sterile and the unit of selection is the colony as a whole. The traits of the colony are larger features of demography-age and size frequency distribution. The effect of relationship between number of castes and number of tasks performed by the colony, and the existence of relation between behavioral repertory of individual workers on the behavioral flexibility and the number of castes in the colony are brought out. This implies that more the behavioral flexibility, the lesser the number of castes. The transition is readily made from polymorphic state in which several physical castes are specialized on sets of tasks to a monomorphic state, in which a single physical caste performs itself all the tasks. The structure of ants society is a special kind called as "dense heterarchy". The colony is dense in the sense that each individual is likey to communicate with any other. The colony is also heterarchy, a hierarchy-like system of two or more levels of units feeding back to influence the higher levels. The highest level of the ant colony is the totality of its membership rather than a specific set of members directing the activity of members at lower levels.

Edward O Wilson (1972) discuss that there is order and structure in ants colony and there is great amount of variation in behavior. Each worker changes its activity as it grows older. This variation in behavior, and hence the division of labor, consists of three components among them,

the two important components are division of labor based on age and caste. In the age based division of labor, there is a tendency for workers after emergence from cocoon to do activities related to inside the nest like brood care, queen care, care of other adult worker,. After a period of time, workers take up outside the nest tasks like foraging and nest construction. In the case of caste based division of labor, there are different castes in ant colony namely, queen, worker and male castes. A caste is defined as any set or group of individuals that performs specialized labor in the colony for sustained periods of time. The queen, workers, males of the colony plays different roles. The queen ant is sometimes referred to as female of the colony. The queen plays an important role in the formation of a colony in the beginning and subsequently engages in the task of creation of workforce for the colony. Despite her title, a queen does not rule. Males live in the colony as dormant member and do not contribute to the colony labour. Males are found in the nest for a short period in the colony before the mating season and they die shortly after mating. The worker ants are non-reproductive female and play very important for the survival of the colony. The worker ants build the nest, forage for food, take care of young, fight predators and do other colony activities. The workers of some ants may consist of two distinct types – large workers also called as soldiers, and smaller workers or minor workers. Major workers of various ant species primarily do one or the other tasks like defense, milling and such others.

George F Oster and Edward O Wilson (1978) state that the differentiation of members into castes and the division of labor based on caste is at the heart of successful ants colonial and social organization. Temporal castes are flexible, in the sense that when faced with emergencies the members of one age group can alter their behavior to take up the roles of other age groups. There is change in individual behavior according to the surrounding environment. A temporal caste is distinguished not only by behavior but also by age.

William Morton Wheeler (1965) observes that the animal behavior is based on either simple responses to sensory stimuli, by instinctive behavior and most importantly plastic or modifiable behavior. There are two types of plastic behavior distinguished in ants, they are, random behavior like the one observed during foraging, and the second type of behavior is that in which an ant is confronted with a new situation and does not proceed to make random movements, but at once adapts to the situation by a process termed as associative memory.

William Morton Wheeler (1923) highlight on the fundamental characteristics of ants, in which plasticity in the behavior is one among them. The plasticity of ants is shown in their care of their young and nesting and feeding habits. Their continua contact with their physical environment, their intimate acquaintances with their broods in all stages has been one of the important factor in the psychological development.

Meredith Belbin (1998) state that organizational principles that have evolved to give ants certain superiority in their organizational behavior can be extracted and adapted for human society. Based on the caste system of ants organization the author points that there are two guidelines which can be applied to human based organization. If a major decision-making function is needed, it should be based on the concept of a cooperating 'caste'. The members of that caste should be selected and trained by coach for the position in the same way as larvae are matured by a nurse in ant colony. The second guideline is based on larvae group of individual 'castes' function efficiently when their separate but their complementary work activities operate simultaneously, in unison free from the delays associated with the hierarchy. This insight can be applied to modern organization by structuring to work around concurrent system, differentiate in terms of function and scope,, but interlinked rather than separated.

Discussions and Results

Ants Techniques: Building Adaptable Work Teams

Nature has played an important role in evolving traits and flexible organizational design in ants. Ant colonies are known to show great resilience through the measured response of their members through behavioral elasticity. Ants respond to sudden catastrophes based on mutual monitoring and exhibiting flexibility in carrying out additional tasks in the demanding situation. Some of the important traits which have evolved and play an important role in establishing adaptable and robust colony are depicted in figure 1 below.

Caste and Roles – Ants live and work together in communities and an ant community is called a colony. In their communities one finds three distinct types of individuals – males, queens and workers (L Huge Newman, 1967). These three groups are called castes (Sigmund A Lavine, 1960). A caste is defined as any set or group of individuals that performs specialized labor in the colony for sustained periods of time (Oster and Wilson, 1978). Holldobler and E.O Wilson (1990) define caste as a group that specializes to some extent on one or more roles. The queen, workers, males of the colony plays different roles. The queen ant is sometimes referred to as female of the colony. The queen plays an important role in the formation of a colony in the beginning and subsequently engages in the task of creation of workforce for the colony. Despite her title, a queen does not rule (Sigmund A Lavine, 1960). Males live in the colony as dormant member and do not contribute to the colony labour. Males are found in the nest for a short period in the colony before the mating season and they die shortly after mating. The worker ants are non-reproductive female and play very important for the survival of the colony. The worker ants build the nest, forage for food, take care of young, fight predators and do other colony activities. Terms like task and role are referred to in the context of division of labor. A task refers to a set of behavioral acts which achieve some function for the colony, and a behavioral act is recognized as a logical unit like grooming, trophallaxis, or carrying a larva and such other acts (Sudd and Franks, 1986). Each task may be made up of one or more behavioral acts. The term task is used to denote a particular sequence of acts that accomplishes specific purposes, such as, foraging or nest repair. A set of closely linked behavioral acts can be defined as a role.

Adaptive Division of Labor – Caste and division of labor lie at the heart of colonial organization in the ants. What make an ant colony distinct is that its internal organization - the differentiation of its members into castes, the division of labor based on caste, and the coordination and integration of the activities that generate an overall pattern of behavior beyond the reach of a simple aggregation of individuals. To explain the system of number of tasks a particular caste perform and how the task allocation takes place there are two hypotheses are formulated. The two types of task management premises are “continuous caste system” and “discrete caste system”.

In the continuous caste system task allocation continuously changes through the life of a worker

and there is no association or grouping of related tasks and hence there are no distinct roles. The important characteristics of the continuous system are − workers are not occupied with distinct set of tasks but carryout different tasks with different probabilities in a particular caste or group, workers have no distinct role allocation due to different tasks, tasks are not grouped, ,task allocation continuously change through the life of worker, nests in small discrete sites, colonies have few hundred workers, opted for plasticity in role allocation and there is flexibility in continuous system since a worker will be probably able to do many tasks.

In the discrete caste system there is distinct changes in task allocation with respect to age. Certain tasks are grouped as a set and these tasks are predominantly performed by certain age class or groups. The important characteristics of the continuous system are − workers are occupied with distinct set of tasks in a particular caste or group, workers have a distinct role allocation due to task distinction, Tasks are grouped, Task allocation change distinctly based on the age class, Colonies have few thousand workers, nests in bigger sites due to large number of workers, Opted for more precise labor and role demarcation with respect to age and Precise form of labour and role demarcation system. . In this system worker can move from one task to another quickly within task repertoire once a given task is completed. This discrete temporal division of labour system contributes to efficient system.

Figure 1. Important adaptive traits of ants organization

Mutual Monitoring and Behavioral Elasticity - is an important trait exhibited by ants and one aspect of social design. The colonies in nature, given their long lives, will be commonly subject to catastrophes like removal of part of their foraging workforce by predators or other phenomenon like floods. There are different ways in which a colony could respond to such sudden changes in the composition of its workforce. First, the remaining workforce expands their behavioral repertoire to cover the tasks of the missing workers. Second, brood development could be swiftly channeled into the production of missing workforce castes. Both the behavioral elasticity and changes in worker production contribute to the resilience of a colony's economy. A few other typical examples are cited herein to demonstrate the capabilities of ants flexibility in behavior are - when 90% of the most efficient size class leaf-cutting workers are removed from a colony, the workers from neighboring size classes adjacent to the most efficient (missing now because it is removed for examining how the resilience is created) quickly fill in for their missing nest mates. The rate of leaf-harvesting remains unaffected by such a crisis because sufficient workers in the size classes adjacent to the most efficient one for the job (now missing) are already present in the foraging area, apparently on a stand-by basis. Thus enough of these substitutes are already present

in the foraging area and more do not have to be called up from the nest. Moreover, the few remaining 'optimal' workers for the task of leaf-cutting stepped up their individual activity by a factor of approximately 5 (Wilson, 1983a). Similar behavioral elasticity is seen when the usual range of minors to majors is 3:1 to 20:1. When the ratio was lowered to below 1:1 in particular ant species, the behavior repertoire size of majors increased by a factor of 1.4 to 1.5 and their rate of activity by a factor of 15-30. The change occurred within 1 hour of the imposed change in ratio and was quickly reversed when the minors were restored (Franks & Sudd, 1986).This suggests that workers in a particular caste seem to be fully aware of the presence and performance of the nest mates, and will quickly step in to the gap if other members are not there or not upto the required level of performing and measured response on the part of individual workers to the needs of the colony.

Self-organization - Social insects like ants exhibit many interesting complex adaptive behaviors, such as emergent properties from local interactions. Self-organization is defined as a process in which activities are neither centrally controlled or locally supervised (Eric Bonabeau and Christopher Meyer, 2001). Camazine et al (2001) defines self-organization as a process in which pattern at the global level of a system emerges solely from numerous interactions among the lower-level components of the system. Moreover, the rules specifying interactions among the system's components are executed using only local information, without reference to the global pattern. That is, self-organizing system functions without central control, and through contextual local interactions. These interactions are often indirect and the system dynamics modifies the environment, and the modifications of the environment influence in turn the system, but without disturbing the internal mechanism leading to the organization. The emergence of self-organization in ants may occur via direct (mandibular, antennation, chemical or visual, etc) or indirect interactions. The latter types are more subtle and referred to as Stigmergy. Grasse coined the term stigmergy to describe a mechanism of decentralized pathway of information flow in social insect (Tony White, 2005).

Well known examples of self-organization in ants are - organize themselves to perform activities such as food foraging, nest building or sorting of broods or bodies. Foraging is the collective behavior through which ants collect food by exploring their environment. During the foraging process, ants leave their nest and explore their environment through a random path. When an ant finds a source of food, it carries a piece of it and returns back to the nest, by laying trails of

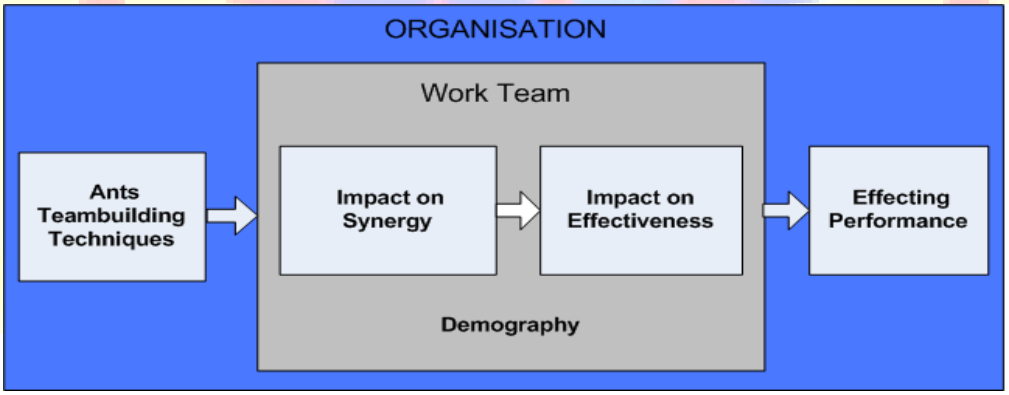
pheromone along its route. This chemical substance persists in the environment for a particular amount of time before it evaporates. When other ants encounter a trail of pheromone, while exploring the environment, they are influenced to follow the trail until the food source, and enforce in their coming back to the nest the initial trials by depositing additional amounts of pheromone, The pheromonal information deposited by insects constitutes an indirect communication means through their environment. That is, self-organized trail laying by individual ants during food foraging is a way of modifying the environment to communicate with the nest mates that follow such trails. Other examples of Ants include collective sorting of broods (eggs, larvae and cocoons) without having a particular ant knowing and applying the sorting algorithm. Ants form piles of items such as broods or bodies or grains of sand. There again ants deposit items at initially random locations. When other ants perceive deposited items, they are stimulated to deposit items next to them, being this type of cemetery clustering organization and brood sorting a type of self-organization and adaptive behavior.

Communication - E. O. Wilson (1972) defined Biological communication as action on the part of one organism that alters the probability pattern of behavior in another organism in an adaptive fashion. By adaptive it means that the signaling, or the response, or both, have been genetically programmed to some extent by natural selection. Ant societies invest a great deal of time in the collection and diffusion of information (Frank and Sudd, 1987). Information probably plays two major roles. They are ‘cohesion’ and ‘coordination’ roles. Cohesion of the society requires that its members know one another, so that benefits of the society may be confined to its members and increase individual inclusive fitness. Many signals are therefore concerned with recognizing colony affiliation to kinship and with recognizing the queen, and coordinating her reproduction and that of workers. The second role of information is in coordinating the exploitation of environmental resources − in foraging, defending broods, queen and nest. There are two modes of communication, direct and indirect modes. The direct mode occurs through tappings, stridulations, stroking, grasping, nudging, antennations, tastings, and puffings and streaking of chemicals which evoke various responses from simple recognition to recruitment and alarm (E. O. Wilson, 1972). Indirect communication is implicit communication that takes place between individuals via the environment. Interactions between individuals can arise through direct or indirect communication.

Ants secrete substances called pheromones, which are chemical messages detected by other ants through sense organs or the antennae. Pheromone based messaging is the oldest and most evolved form of biological signaling, using chemicals to communicate through smell and taste. Chemical signals or pheromones as they are now generally called play the central role and as a primary communication vehicle in the organization of ant societies. The typical ant colony operates with somewhere 10 to 20 kinds of signals and most of these are chemical in nature and others being tactile in form like tapping or stroking (Holldobler and Wilson. 1990). Pheromone messaging has the following characteristics (Ken Thompson, 2008):

Pheromones are used to broadcast information to large groups, they can also be used to communicate between individuals, Pheromone messages do not require a reply, they are based on simple, stimulus-response templates and contain no complex information, robust delivery where messages can flow round an obstacle in their path (unlike visual messaging) and "Darkness Transmission", where the messages can be transmitted and received at night, give location information and such others.**A SCHEMATIC MODEL SHOWING THE**

STRUCTURAL IMPACT OF ANTS TEAMBUILDING TECHNIQUE ON THE RELATIONSHIP BETWEEN SYNERGY, EFFECTIVENESS AND PERFORMANCE IS PRESENTED BELOW.



This schematic model is the derivative of the critical analysis of the application of Ants teambuilding techniques in the work teams. It depicts the responses of the Ants teambuilding technique and relationship to the team performance. The Ants technique has direct impact on both synergy and effectiveness. There is also an effect of synergy on effectiveness. The sum

total of these effects results in higher team performance together with more robustness and adaptability.

Findings

FINDINGS RELATED TO TWENTY WORK TEAMS BEFORE THE APPLICATION OF ANTS TECHNIQUES.

- There is a difference in the mean value between the test and respondents perceived values of the attributes of Synergy. This difference is found to be significant, except Communication and Mutual Understanding. On the whole, it can be inferred that the teams are confronted with problems due to lack of sociability, cohesiveness, cooperation, trust, mutual support, commitment, harmony, mutual accountability and shared goal.
- The mean value of overall Synergy of twenty teams is 3.46 which is lower than the test mean value of 3.5. This shows that there is scope to attain or improve the Synergy levels of twenty teams.
- There is a difference in the mean value between the test and respondents perceived values of the attributes of Effectiveness. The difference is observed to significant among the Effectiveness attributes, except one attribute Job Satisfaction. All other attributes are statistically having significant difference as compared to test value. This indicates that the overall Effectiveness of the teams is lower.
- The mean value of overall Effectiveness of twenty teams is 3.38 as compared to the test mean value of 3.5. Hence there is more scope for teams to enhance their overall effectiveness.
- The stated null hypothesis that "The organizational teams are not confronted with any problems and hence there is no impact on team Synergy and Effectiveness" is rejected and consequently alternate hypothesis is accepted.
- The study shows that there is more scope for the teams to attain the higher level of Synergy and Effectiveness before the application.

FINDINGS RELATED TO TEN WORK TEAMS AFTER THE APPLICATION OF ANTS TEAMBUILDING TECHNIQUES.

- There is difference in the mean value of Synergy attributes before and after the application of ants technique. The mean differences between pre/post are negative and significant, except Commitment attribute. It can be seen that there is positive improvement in the Synergy attributes mean levels between pre/post applications and hence it can be inferred that the team problems have reduced and there is improvement in Synergy in the teams.
- It can be seen that the mean difference of Commitment attribute has increased marginally (0.06) as compared to other Synergy attributes. The reason can be due to that individually the members are committed even before the application of ants technique. But, the overall team performance depends also upon other attributes, group dynamics and environment in which team operates.
- The teams are confronted with reduced problems after the application of Ants teambuilding techniques. The overall Synergy mean score before and after the application of ants teambuilding techniques are 3.29 and 3.86 respectively and found the difference significant.
- The stated null hypothesis that "There is no impact of the selective Ants based technique on the team Synergy" is rejected and as a result alternate hypothesis is accepted.
- There is difference in the overall mean values of Effectiveness attributes before and after the application of ants technique. The mean difference between pre/post mean values is negative and the difference is significant. It can be seen that there is positive improvement in the attributes mean levels and hence it can be inferred that the team problems are reduced.
- The mean value of Effectiveness attributes has improved after the application of selective Ants teambuilding techniques. The mean difference value is statistically significant. This shows that teams are more effective as indicated by the overall

Effectiveness mean score before and after the application of ants teambuilding techniques, which are 3.18 and 3.82 respectively.

- The stated null hypothesis that "There is no impact of the selective Ants based technique on the team Effectiveness" is rejected and as a result alternate hypothesis is accepted.
- Teams applied with selective Ants techniques have shown that the mean value of the all the attributes of Synergy are higher than the pre-application mean scores in all the ten teams. Hence, the mean difference value between the pre and post application is observed to be negative in all the ten teams. This shows that there is effect of ants techniques on the attributes of Synergy to varying extent. Modify show max and min value for each attributes of Syergy and Effectiveness .
- In the teams with higher mean difference of attributes between the pre and post mean value scores and the difference is significant consequently in such teams the Synergy is higher.
- In the teams with lower mean difference of attributes between the pre and post mean value scores and the difference is not significant then in such teams there is scope to improve the attributes and therefore team Synergy.
- Application of Ants techniques has enhanced the levels of the synergy attributes like sociable. Cohesiveness, Cooperation, trust, Mutual Support, Communication, Harmony, Mutual Understanding and Mutual Accountability have shown significant improvement. Only the Commitment and Shared goal attributes have shown marginal increase before and after the application of ants techniques.
- In majority of the teams there is lower difference between the mean values in the attributes of Commitment and Shared goal before and after the application of ants techniques. This may be largely due to individually the respondents may be committed and willing to share the common goal in the teams but this alone may not make the team perform with higher synergy. The other attributes also needed to harmonize with the commitment and shared goal attributes in the team for improving Synergy and performance.

- There is significant difference in synergy between pre and post application of Ants team techniques in the teams.
- Teams applied with selective Ants techniques have shown the mean value of all the attributes of Effectiveness is higher than the pre-application mean scores in all the ten teams. Hence, the mean difference value between the pre and post application is observed to be negative in all the ten teams. This shows that there is effect of ants techniques on the attributes of Effectiveness in varying degrees.
- The study shows that the mean differences of the attributes like Adaptability, Member Development, Recognition and Rewards between pre and post are negative indicating there is positive effect of the technique but the difference is lower and not significant. There is scope to improve further through reinforcing the technique and necessary resources.
- There is significant difference in Effectiveness between pre and post application of Ants team teambuilding techniques in the teams.

Conclusion

The Study of ants social and flexible organization provides an insight about their adaptability and robust structure. Appropriate ants based techniques like mutual monitoring and behavioral elasticity, flexible caste and roles, effective communication, adaptive division of labor for creating flexible or efficient organization, self-organization and flexible heterarchy structure can be used as guidelines and applied in organizational work teams to make more responsive to the challenges and also become more adaptive in order to succeed the changes and challenges in the business environment. Man from time immemorial is learning many things from nature and has drawn inspiration from the natural world. Man is looking for ideas from nature and adopting them in technologies, management and other areas. Nature's design have been tested and tried over the course of millions of years of evolution. Work teams are increasingly used by many organizations in almost every segment of the economy. Teams are formed for multiple benefits in the workplace. Teams are sometimes successful and sometimes unsuccessful. Hence the performance is not consistent. There is a need for innovative solutions to make teams more successful, consistent and responsive to changes. The study of nature's best ideas from living system and then imitate to solve human problems is called Biomimetics. Bioteaming is biomimetics for group behavior. Bioteaming is about building organizational teams that operate on the basis of natural principles that underpin nature's most successful teams.One such area for learning from nature is to look at nature's most successful living biological teams like Ants which can provide useful guidelines on how teams need to operate to be truly successful and apply the nature's wisdom and successful team behaviors of extended cooperation and effective collaboration in organizational work teams in order to become more successful, consistent and adaptable to

changing environment. Nature offers us an invaluable wisdom learned and tested over the course of millions of years. The key Ants teambuilding behavior and organizational principles that have evolved to give Ants certain superiority can be adapted in human based organizational work teams. The key Ants teambuilding behavior and organization system are grouped in to four categories namely, Social Factor, Task Factor, Member Factor and System Factor.*Social Factor* is an important trait of Ant organization. The pathway to social integration involves a combination of EUSOCIALITY, GENETIC BONDING and INCLUSIVE FITNESS and other aspects. EUSOCIALITY – can be characterized by four main criteria namely overlapping generations, cooperative brood care, philopatry (is when individuals remain living and working in their birthplace) and reproductive altruism. GENETIC BONDING – workers in Ants colony are genetically closely related to each other. INCLUSIVE FITNESS – is a trait of ants where the member's fitness depends not only on its own survival and development but on the fitness of other members.

Suggestions

The recommendations are given below:

- Ants based teambuilding techniques is an innovative and effective method that provides the work team and organization an enabling structure without destroying autonomy and intelligence unlike centralized leadership and hierarchical structure.
- The combining of the devolved but integrated strengths of the ants teambuilding techniques with the directive and strategic abilities of human can make organizational work teams more efficient, adaptive and successful.
- Ants based techniques needs to be applied with an integrated approach like appropriate structure, resources and enabling norms for better results.
- Management and members support are important for successful implementation of Ants based teambuilding techniques.
- Team Building is not a "one-time cure" for sustaining team Synergy and Effectiveness. It is an on-going process.
- Regular training and development activities in team work to the members will enable in building the work teams with higher Synergy and Effectiveness based on ants techniques.

- Members need to be provided with regular training and experiential learning courses in the areas of interpersonal relations, emotional intelligence, positive attitude building, communication, conflict resolution and such others improves personal and interpersonal and effectiveness of members.

- Development of multi-skills and task resilience for the members will enable to create an adaptive workforce.

- Hierarchical structure and centralized leadership can be replaced by a flat team structure and co-operating leadership which enables team empowerment, more transparency, better communication, collective decision making, mutual accountability and faster execution.

- Management to take initiative on providing team based rewards and recognition to motivate the team to work collectively and towards common vision always. This will improve and develop inclusive fitness attitude among the team members.

- Team to collectively create norms or *swarm rules* on consensual basis to deal with the team activities like setting team values, task management, conflict resolution, sharing of benefits, team training and development and others. This will develop robust and resilient team

- Exploring the application of Ants techniques specially based on Swarm Intelligence and Bioteaming, to new areas for improving the operational efficiency and strategic excellence.

- Based on research in evolutionary biology, psychology, sociology, political science and experimental economics suggests that people are more cooperative and less selfish than people believe. These findings suggest that instead of using controls and carrots and sticks to motivate people, organizations or leaders should use systems that rely on engagement and a sense of common purpose.

- Several levers can help build cooperative system: encouraging communications, ensuring authentic framing, fostering empathy and solidarity, guaranteeing fairness and morality, using rewards and punishments that appeal to intrinsic motivations, relying on reputation and reciprocity, and ensuring flexibility.

- Getting people do their best work requires meeting the emotional needs like need to that people are guided by four basic emotional needs. These are drive to acquire for well-being, drive to bond with kith and kin, friends, organization and others leads to positive emotions drive to comprehend and drive to defend. It is suggested that each need or drive is best met by a distinct lever at the organizational level - reward system for drive to acquire, culture of the mutual reliance and friendship for drive to bond, design jobs that have distinct and important roles for drive to comprehend, and improving transparency in appraisals, resources and recognition for drive to defend accomplishments, ideas and beliefs.

SCOPE FOR FURTHER RESEARCH

This study only represents a first step within a broader research program about organizational learning and the identification of supportive and enhancing organizational tools. Organizational learning has been studied from a wide variety of perspectives, and it has been generally acknowledged that the phenomenon is of increasing importance for survival in uncertain and turbulent environments. Still, our understanding is limited, and the different research traditions remains splintered. Organizational theory, cognitive psychology, strategy and information systems are approaching learning from different points of view, concentrating on particular issues. Recently, some integrative efforts have been made, but I believe that there is still a long way to go I have been participating in other in-depth studies similar to this one. The comparison of the findings of each of the studies will hopefully help to verify and refine the propositions of this research, further elaborating on the findings that have emerged from this study. In particular, more work has to be done to deepen our understanding about supports to individual and collective learning processes.

- Behavioral models of social insects or other animal societies that can stimulate new algorithmic approaches.
- Empirical and theoretical research in swarm intelligence.
- Application of swarm intelligence methods, such as ant colony optimization or particle swarm optimization, to real-world problems.
- Theoretical and experimental research in swarm robotics systems.

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