

## Geotechnical Engineering and Management for Experience Economy

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### ABSTRACT

Geotechnical engineering and management practice that is carried out today is based on the procedures and policies suitable for industrial and service economy. Next generation economy which is the experience economy [1] needs a delivery mechanism where the authentic levels of quality experience are improved upon while performing the engineering function. With the advent of semantic web it is possible to make the wisdom available to the context in the form of change management suggestions, so that the defects are reduced and productivity levels are improvised and quality of experience levels are improved. In order to meet the above objective, implementation of delivery mechanism based on the experiential system concepts is explored and ontology was developed by incorporating the geotechnical engineering concepts in the experience delivery framework as a use case realisation.

### 1. INTRODUCTION

Geotechnical engineering practice carried out so far is suitable for industrial and service economy. Experience economy [1], which is next generation economy need a delivery mechanism so as to improve on the authentic quality level of experiences.

Clues from the experiential system i.e. engineering and management delivery mechanism based on doctrine of honey, Madhuvidya [2] and Lalitha sahasranama [3] were taken and the same were applied to the geotechnical engineering and management by making necessary mappings as applicable to the today's management and engineering context.

Projects which are of very huge magnitude such as construction of underground metro need to cater to the day to day changes in lieu of the changes at site, changes to the provisions in code etc. The effects of changes may induce stress leading to the anxiety connected with the loss of sense of security, sense of competence, relationships, sense of direction and control, territory and job [4]. Also it takes time to implement changes.

Change induced stress could result in defective work and lead to poor experience quality levels. In order to efficiently manage the project with better quality level of experiences, the help of the technologies like semantic web can be of use for making the appropriate wisdom available to the context.

Some clues with regard to the evolution of personality are taken from the experiential system and its application with regard to the human-soil interaction was discussed keeping in mind the authentic quality of experience levels (temporary and permanent nature of experience).

By staging experiences which are transformative in nature leads to evolution of being thus adding to the authenticity of quality levels of experience.

In order to enable the above objective, a 4 phase soil system was introduced and a use case was implemented by incorporating the geotechnical engineering in the framework of

Madhuvidya [2] and Lalithasahasranama[3]. Also implementation of a sample soil classification was done in the delivery frame work ontology.

## 2. DEFINITIONS

### 2.1 EXPERIENCE ECONOMY

ECONOMICS, MARKETING an economy in which many goods or services are sold by emphasizing the effect they can have on people's lives[5]

### 2.2 ONTOLOGY

Ontology is the conceptual data model used to link data together other more granular data models in order to reach an agreement on data meanings either by committing to shared vocabularies or by explicitly modelling the vocabulary differences, context, and meaning [6]. Ontology can also be defined as a model of any bounded region of interest expressed as concepts, relationships, and rules about constructs and association of interest to the modeller [6]

### 2.3 SEMANTIC WEB

The semantic web is the extension of the current web in which the information is given a well-defined meaning, better enabling computers and people work in cooperation [6]

## 3. NEED FOR DELIVERY MECHANISM ANALOGOUS TO HUMAN BEING

By staging experiences there will be higher economic value when compared to commodity, goods, products or services.

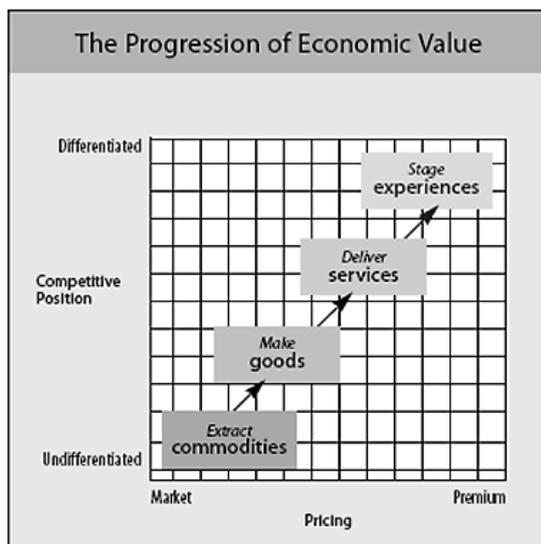


Figure 1 Progression of economic value[1]

The more the senses engage in experience, the more effective and more memorable it can [1]. Also if the heart and spirit is involved apart from involvement of hands and minds in the delivery mechanism then quality of experience level is increased [7].

If the delivery mechanism when modelled analogous to human being having sense organs, mind,

heart and the being comprises of different levels i.e.

1. Physical

2. Intellectual
3. Negative emotions
4. Positive emotion (Bliss)
5. Conscious level
6. Subconscious level
7. Mentors state of being
8. Engagement of being
9. Complete accomplishment of focused being

then quality of experience can be enhanced and also desired objective can be achieved[3], as an

organization is collection of individual beings, individual being is a collection of tendencies and

change at tendency level of individual being will have effect on overall experience level and accomplishment of the organization.

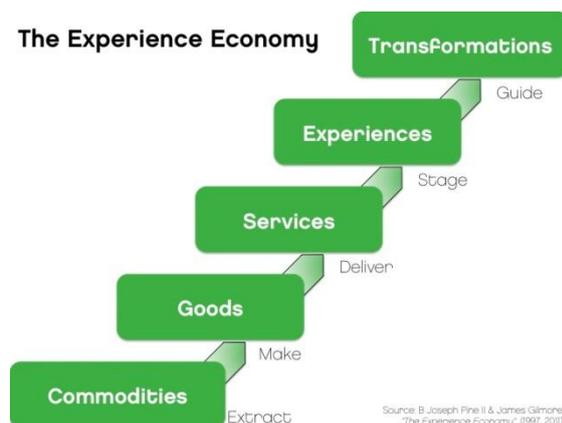


Figure 2: Depicting the transformation aspect

Also the current state of experience level can be changed by following appropriate transformation

model at different levels of being.

In order to enhance the quality of experience level of the people involved in the delivery mechanism, hints can be taken from the experiential system as the knowledge derived is based on the wisdom realized after long drawn contemplation and churn of the sages of the yore. The same was committed to memory and passed on through word of mouth and this transfer of wisdom has happened for generations since its effectiveness was found to be true on application of wisdom.

#### 4 APPLICATIONS OF SOME EXPERIENTIAL SYSTEM CONCEPTS

One of the knowledge body in experiential system is Madhu Vidya , the doctrine of delight [2]. The structure as envisaged in the knowledge body if applied for delivery mechanism of service or product then the resultant one may lead to improvement in quality of experience levels .The objective of the paper is not to prove the effectiveness of the framework in

improvement of the quality of experience level but to ideate ,develop the framework and apply it to the moderncontext so that the implementation feasibility is studied such that quality of experience levels can be measured and evaluated at a later stage.

Another knowledge body from experiential system is Lalitha Sahasranama[8] .It deals with different layers of the being. The knowledge body comprises of 1000 attributes compiled in 183 stanzas. Roughly equates to 20 stanzas times 9 .Each of 20 stanzas deal with a particular level of the being. For example first 20 stanzas deal with physical aspect of consciousness. If all 180 stanzas were to be analyzed then following aspects of the being is dealt in the knowledge body.

1. Physical
2. Intellectual
3. Negative emotions
4. Positive emotion-bliss
5. Consciousness
6. Sub consciousness
7. Mentors state of being for transformation
8. Engagement of being for involvement
9. Complete accomplishment of focused being for achieving the desired objective righteously despite non conducive environment and in true spirit [8].

**4.IDELIVERY**

**MECHANISM-HUMAN**

**ANALOGY**



Plan of delivery mechanism



Cross Section AA of delivery mechanism

Figure 3: Plan and section of delivery mechanism

Following is the one of the approach where entities in the Doctrine of Delight [2] are mapped to the modern context.

Sr No	Element in plan Doctrine of delight[2]	Mapping Element
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Sr No	Element in plan Doctrine of delight[2]	Mapping Element
1	Corporeal elements	1.Personnel 2.Resources 3.Facilities 4.Supply Chain dependent entities 5.Equipment and machinery 6.External dependent entities
2	Life	Tacit Knowledge 1.Culture-Management by consciousness 2.Ethos
3	Mouth	System communication-Internal and external
4	Eye	Future: Vision statement Present: Monitoring and control records Past: Past records, lessons learned records
5	Ear	Feedback from 1.Customers 2.Stakeholders 3.Employees 4.Vendors 5.Partners
6	Light	Innovation, Leadership, Constructive Criticism

Sr No	Element in plan Doctrine of delight[2]	Mapping Element
7	Space in heart	System constants 1.Spirit 2.Values
8	Mind	Conscious Mind: Knowledge Management Finance Management Design management etc. Emotional health: Reduction on negative emotions Enhancement of positive emotions Subconscious Mind Incubation etc.
9	Righteousness	1.Post-delivery request fulfillment 2. Trainings 3.Employee welfare
10	Voice	1.Customer satisfaction 2.Stakeholder value 3.Employee satisfaction
11	Truth	1.Audits 2.Testing 3. Reviews
12	Mankind	1.Value contribution to society 2.Corporate social responsibility
13	Cosmic body	1.Sustainability 2. Knowledge 3.Bliss Contribution
14	Breath	Continual Improvement

Table 1: Mapping of elements in plan of the delivery mechanism

Sr No	Cross section element of delivery mechanism comprising layers of being
1	Physical layer
2	Intellectual layer
3	Negative emotions layer
4	Positive emotions layer
5	Conscious layer
6	Subconscious layer
7	Mentoring layer
8	Engagement layer
9	Accomplishment layer

Table 2: Elements in the cross section of the delivery mechanism

Another knowledge body is “Aparajitha Stuti”[9] which deals with 22 aspects of consciousness which when respected in self and others involved in the decision making then the chances of that decision going wrong is minimum. It also acts as cohesion aspect in delivery system and leads to enhancement of bonding among the entities of the system. Also defect prevention is possible.

## 5. MULTI PHASE SYSTEM OF GEOTECHNICAL ENIGEERING FOR EXPERIENCE ECONOMY

Engineering and engineering management fields also require catering to the market demands where the authentic quality levels of experience need to be improved. In order to achieve the above objective there is need for the delivery mechanism where the authentic quality levels of experiences are improved.

Moreover the engineering, management, architecture domains cannot work in silos and there is need for the collaboration amongst all the entities involved in the system so that the working of the entities is carried out in the harmonious manner if considered from the system point of view.

It is also observed [8] that the quality of tendencies has role to play with regard to the authentic quality of experience levels. The more the tendencies are towards the materialistic realm then the resultant quality level of experience is temporary and the tendencies of being evolves with time and association of the right people.

As the tendencies evolve to a better state, there will be increase in focus levels, awareness levels and quality of experience levels [8].

It is also observed that the above mentioned focus, awareness and quality of experience levels are the function of quality of tendencies [8]

As the quality of tendencies get refined and refined to the further levels by way of continual improvement a stage of awareness will be achieved where the distinction between the animate and inanimate is eliminated and state of equanimity is achieved [10].

As being evolves to further stages there is a possibility of tweaking the engineering properties of element of nature including earth (soil and rocks) for the benefit of mankind. For example stopping of a landslide by a Himalayan master. [11]

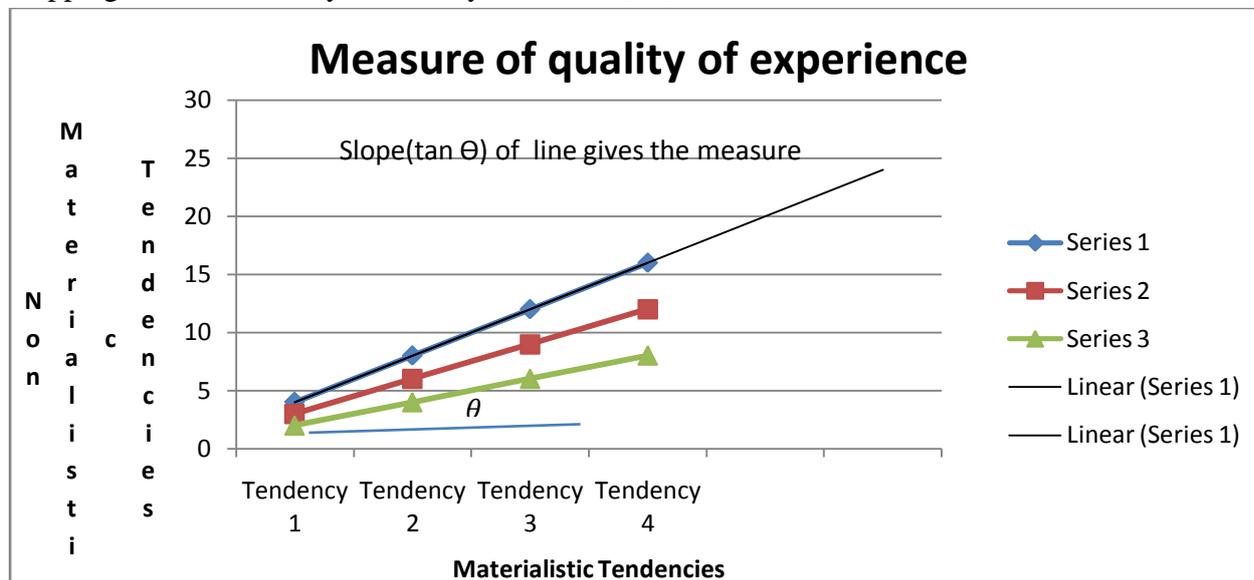


Figure 5: Figure representing the angle between the materialistic tendencies and non-materialistic tendencies as a measure of quality level of experience

As the materialistic tendencies covert to non-materialistic tendencies and on further refinement quality level of authentic experiences increases, along with the focus levels [8].

As the quality of tendencies change the meaning with regard to quality of experience changes.

More over in the recent advances in the earth sciences it getting evident that earth is living entity [12].

Also soil is a dynamic living layer [13].

In light of the above observations it can be summarized that effective awareness plays an important role in soil human interaction and the authentic quality level of experience which is needed for the experience economy.

Accordingly the three phase diagram of soil may be modified as four phase system for a soil mass.

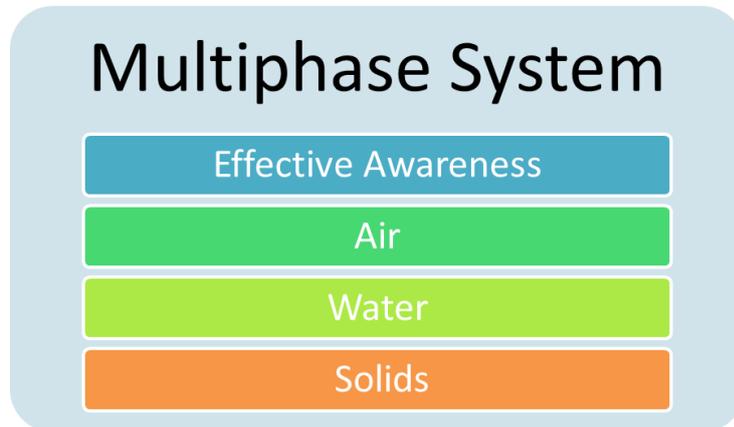


Figure6: Figure representing the multiphase soil system as applicable to experience economy

Effective awareness may be represented as 100- awareness of materialistic tendencies. Also it is observed that quality level of experience, focus levels and awareness levels are a function of quality of tendencies.

$$\text{Quality level of authentic experience} = f(\text{Quality of tendencies})$$

$$\text{Focus levels for achievement} = f(\text{Quality of tendencies})$$

$$\text{Awareness} = f(\text{Quality of tendencies})$$

Earth (Soil/rock) continuously provides information with regard to odour, touch, taste, visibility, sound which can be used for staging of better experiences and experiences can be of transformatory in nature where the authenticity levels of experience are increased.

## 5. IOT AND SEMANTIC WEB

Using internet of things and sensors it is possible to gather the information with regard to senses(odour, touch, taste,visibility,sound) and using the artificial intelligence of semantic web it is possible to interpret what means with regard to the experience of the person having the likes and dislikes depending on the maturity/ evolution of being of a person.

It is also possible to interpret the writings, the online activity, the speech of the people and using the statistical modelsit's possible to arrive at the materialistic and non-materialistic tendencies of the people and accordingly quantify the effective awareness level of particular user for staging experiences for better quality of experience levels.

## 6. PROPOSED STRUCTURE

The concept of considering a proposed structure as living entity is not new. It is practice existing in the form of implementing vastu [14] which considers not only the structural aspect but also the energy, orientation etc. of the structure in order to enable the transformation of the being so as to increase on the better quality of experience levels.

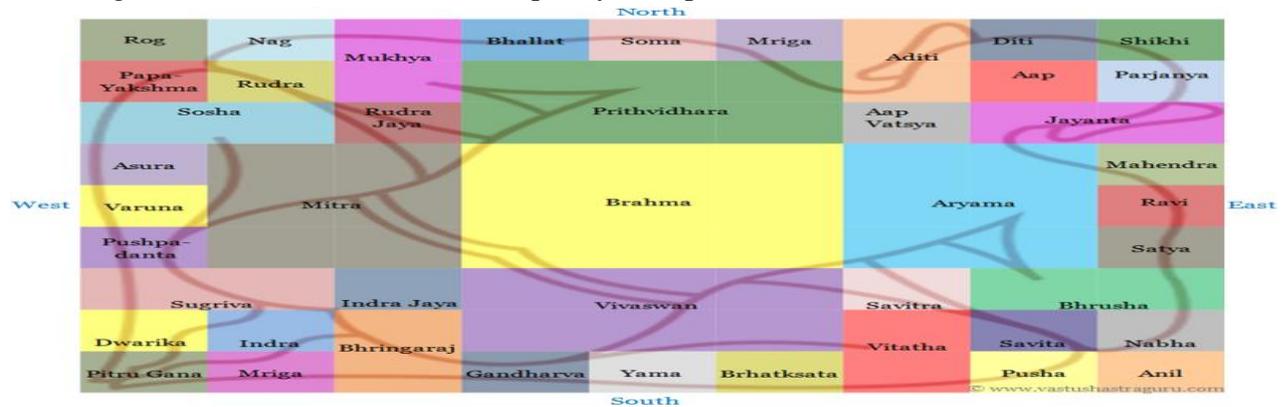


Figure7: Figure depicting the proposed structure as a living entity

## 7.USE CASE REALISATION

Using protégé, the model can be represented for engineering and management delivery mechanism and the proposed structure as living entity can be represented as follows

The multiphase representation of the particulate system can be modelled as follows

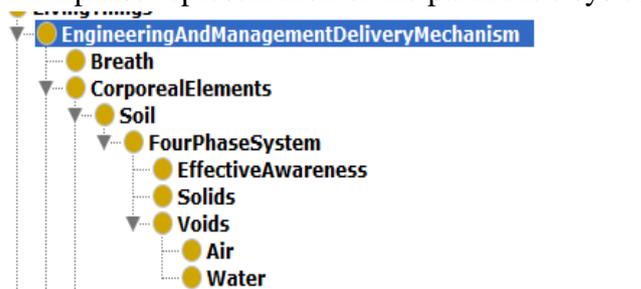


Figure 8: Multiphase system representation in ontology

The provision for evaluating the tendencies at different levels of the being can be modelled as follows

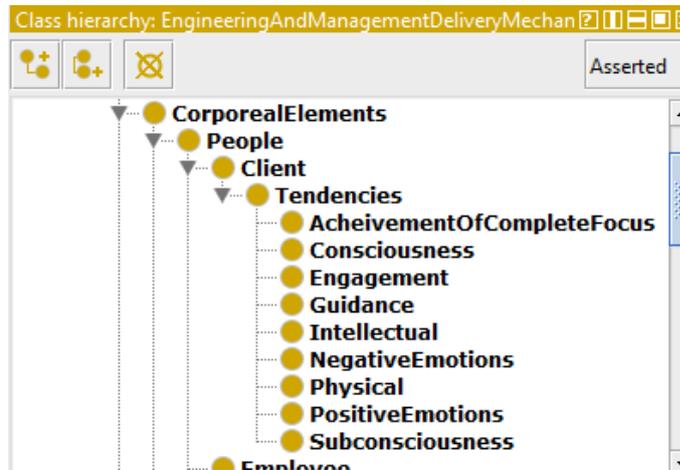


Figure 9: Representation of tendencies in ontology

The provision for geotechnical design along with other management entities can be modelled as follows



Figure 10: Representation of geotechnical engineering and management in ontology

Some of the geotechnical engineering proportioning terms can be represented in the model as follows



Figure 11: Representation of different volumetric and gravimetric proportioning of soils

The implementation can be done by giving meaning to the classes and rules [15], for example engineering soil classification can be done by giving meaning as follows

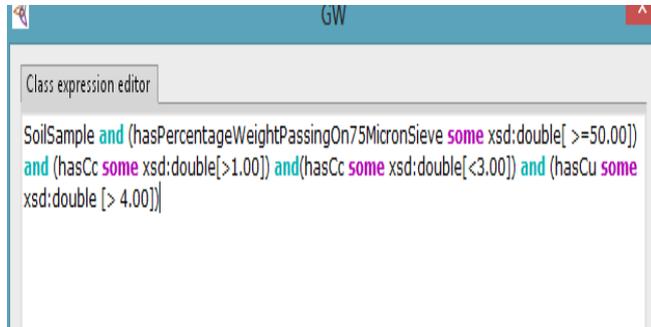


Figure 12: Representing the meaning given to class

The result that will be obtained on running the reasoner will be as follows

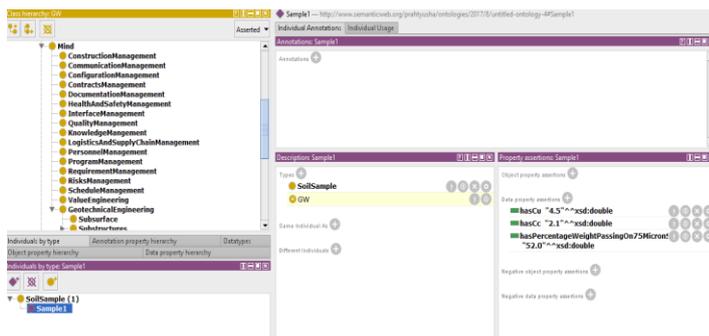


Figure 13: Inference on implementation of soil classification in the framework

In similar fashion the classification and performance of calculations for void ratio etc. can be done by

using SWRL rules. In the similar manner change management suggestions can be made available to

the context.

## SUMMARY

An engineering and management delivery mechanism based on the experiential system was taken

and mapped to the current context in order to cater to market demands of improving on the

authentic quality level of experience of people, since the scope of projects that need to be

management now a days is huge and changes that need to be made adaptively by taking necessary

actions are of higher order proportion.

In order to have better quality of experiences, a 4 phase soil system was introduced by the taking

clues from the experiential system such as Madhu vidya and Lalitha sahasranama.

An ontology of delivery frame work was developed and portion of the soil classification was

Implemented as a use case.

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## 7. ABBREVIATIONS

IOT: Internet of things

SWRL:Semantic web rule language

V: Values