Involvement of Tacit and Explicit Knowledge and its Management during Qualitative Learning in a Software Engineering Environment

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Abstract: The role of involvement of knowledge as well as reusable knowledge in the software engineering environment has been analyzed. It is being proposed that a tacit and explicit knowledge both play significant role in qualitative learning. Key features of revised Nonaka and ADRI models have been accounted to justify present work. It has been found that Nonaka and ADRI models have similarity with tacit and explicit knowledge conversion processes in the software engineering environment. In addition reusable knowledge boosts in the learning activities. Present work helps us to enhance the quality of learning tacit and explicit knowledge strategies. Present work facilitates to create a better approach to achieve learning by adopting three dimensional knowledge management model through which the concept of time, space, place, technology, and interaction can be considered simultaneously which could play an imperative task in understanding the more practical contribution of both tacit and explicit knowledge as well as their reuse.

Keywords: ADRI Model, Knowledge Reuse, Three Dimensional Knowledge Management, Software Engineering Environment, Learning and Quality.

I. INTRODUCTION

Knowledge Management (KM) and knowledge reuse in software engineering environment help to track the viability and quality of knowledge not only in the every-day life while in our professional arena also. It is anticipated that institutes require technological help in creating strategies to understand the feasibility and future applications of the knowledge. Knowledge normally has two parts tacit and explicit that verbal and documented. It affects learning strategies that how can we apply, reuse and handle the tacit and explicit knowledge? It is establishment fact that quality of knowledge and reusable knowledge in the software engineering environment is ultimate objective for every organization which captures, distribute and transport the knowledge. Knowledge is constantly concerned in learning when it is conveyed from faculty to students. Therefore understanding of quality learning is required to diagnose the real value of an organization. Use of technology alone cannot answer this question, therefore, we need to evaluate knowledge and reusable knowledge strategies in a quality oriented environment in the higher educational system if we want to apply knowledge management objective across the entire spectrum of higher education.

Work of Bernbom [1, 2] highlights that Knowledge Management comprise the "discovery and capture of knowledge, the filtering and arrangement of such knowledge, plus the significance derived as a result of sharing of knowledge". Kidwell et al [3] mentioned that we have large prospect of knowledge applications in the higher learning organizations. Work of Thorn [4] suggests that it is not an easy task to realize the knowledge management in higher educational segment, to its widespread significance [2]. It is interesting to note that (so far the author knows) no one has studied tacit and explicit knowledge involvement in a three dimensional qualitative learning environment where knowledge reusability plays a key role. Work of Abdulla et al. and Harsh & Banga [5, 16] theoretically described that ADRI model [6] may be similar to Nonaka model so far as the knowledge conversion is concerned. Their description was based on the theoretical work of Harsh [10-12, 18] which was the extension of well known knowledge conversion processes in two dimensional model of Nonaka [7, 8] to three dimensions. This work throws the light on the quality of reusable data, information and knowledge [21]. In the present work similar knowledge conversion approaches with tacit and explicit knowledge as well as their reusability have been taken by using a software engineering oriented learning environment.

II. KNOWLEDGE VIEWPOINT AND REUSABILITY

Quality is an important issue for the tacit as well as explicit knowledge and its associated software engineering setting. Software quality is really influenced by its related tacit and explicit knowledge and its application procedures. In the spirited situations, expansion of tacit and explicit knowledge and concerned constituents of data has imperative accountability in the altering software quality tendencies. Quality of tacit and explicit knowledge components on top of its reprocess is not a simple job in varying electronic era. Administration and reuse of tacit
and explicit knowledge components should be properly incorporated into the existing system in order to maintain the quality of the system. Reusable knowledge (tacit or explicit) is an important aspect not only in saving efforts and costs while also for enhancing the quality of the software knowledge. We can make a reusable knowledge warehouse which could be exploited for its future applications. Harsh [11, 13] has submitted a model of the effective reuse of data, information and knowledge and its reusability which includes required wisdom by extending the well known work of Bellinger et al.’s [15] of “Data, Information, Knowledge and Wisdom”. This work is also helpful in understanding the quality of the related processes.

III. BASIC KNOWLEDGE MODEL AND ITS APPLICATIONS

Nonaka and Takeuchi [7, 8] proposed the basic model on Knowledge Management which includes conversion processes from tacit to explicit knowledge and vice versa. This model reveals the applications of four types of knowledge styles in the two dimensional circumstances where conversion from tacit to explicit (and vice versa) can take place as shown in the Figure 1 below:

![Figure 1: Nanaka and Takeuchi Model (1995) or SECI Model](image)

Nonaka and Takeuchi [7, 8] put forward that there is a repeated learning process in an institute which is responsible to enhance the knowledge like a spiral as shown in the Figure 1. Nonaka and Takeuchi [7, 8] added that knowledge rearrangement between human beings take place in sequence as shown by Figure 1 above. Four structures of knowledge changes as exposed in the Figure 1 are ceaselessly there in the advanced educational settings. This is the reason that why a higher educational environment needs a learning system. Off-course technology is helpful in the rapid and accurate transformation of knowledge. Work of Kusunoki et al. [9] proposed that the multifaceted knowledge is observed in an organization which clarifies the ability of organizations’. They suggested that presence of knowledge in such a way represent the separate behavior in form of each layer. They further submitted that each layer is a unique one. Work of Abdulla et al. [5] proposed that four types of processes are possible in a higher educational environment like Nonaka and Takeuchi’s [7, 8] model which might evolve to create a qualitative learning environment by involving the Socialization, Externalization, Internalization and Combination processes as mentioned in the Figure 1 above. In the present work author would like to suggest that reuse of knowledge during the four above mentioned processes also takes place in addition to conversion processes from tacit to explicit (and vice versa) which eventually enhances the quality of the system due to repetition of knowledge (or data, information and knowledge). However, in the present work it is being suggested that quality of such converted knowledge can be monitored by applying the well known quality model as mentioned by ADRI model [6] (Figure 4 below).

IV. NANAKA AND TAKEUCHI MODEL (1995) AND IT SEXTENSION:

Model of Nonaka and Takeuchi [7, 8] suggest that knowledge changes from explicit to tacit and vice versa in two dimensional learning environments through four processes as mentioned in Figure 1 above in the form of a spiral. Without the above four processes any kind of learning process in higher educational systems is not possible. Work of Harsh [10-12, 18] further claims that reusability can form the third dimension in the Nonaka and Takeuchi’s [7, 8] model which should be taken into consideration in this model (see Figure 2 below).

![Figure 2](image)

![Figure 3](image)

![Figure 4](image)
During learning, transformations of these two types of knowledge form the continuous processes which will eventually help in creating useful learning environment (Kusunoki and Nonaka [9]). Kusunoki and Nonaka [9] suggested the awareness of multilayered knowledge where knowledge is a layer that comprises distinguishing entity components of knowledge “(e.g. functional knowledge embodied in a specific group of engineers, databases, patents, etc.)” Similarly in the present work it is being suggested that the four processes of Figure 1 evolve in the three dimensional space as mentioned in the Figure 2. Work of Piccoli et al. [19] demonstrates that learning space can be understood on the basis of time, place, and space (Figure 3). They further explained that technology, interaction and control should be incorporated to facilitate better learning. However, their work did not include the concept of reusability, quality of tacit and explicit knowledge.

V. APPROACH, DEPLOYMENT AND RESULTS AND IMPROVEMENT (ADRI) MODEL:
To analyse the quality of data, information and knowledge (Abdulla et al. [5], Harsh and Banga [16, 20]), the assessment practices may be repeated on four major features: approach, deployment, results and improvement (ADRI) with a popular name ADRI model. According to Jantti [5] ADRI model is capable to identify the “relations among stated objectives and results by the enquiries” It includes “what do you intend achieve from the stated goal”? “What resources are required?” “How and when will it be done”? “What outcomes were achieved?” Were these produces a straight result of arranging the approach? What requires being completed superior or another way to improve the approach? Jantti [5] added that a determined assessment technique presses the institute to find out the institutions with a technique to decide the connection among goals and acts. Moreover, Jantti [5] stated that the subsequent four approaches under the ADRI model are:

1. Approach Thinking and planning
2. Deployment Implementing and doing
3. Improvement Learning and adapting
4. Results Monitoring and evaluating

Above four phases can be interpreted to indicate the Nonaka’s [7, 8] four conversion forms (Abdulla et al. [6], Harsh [10, 11, 18]) as mentioned by the Figure 1 above. Though, it should be reminded that this model does not comprise the idea of knowledge reusability. Below interpretation of these four processes are being mentioned from the present point of view.

APPROACH THINKING AND PLANNING:
This phase requires the conversion of tacit knowledge into explicit knowledge. Once the tacit knowledge is finalized (after approach and thinking), we need the planning of tacit knowledge transformation into explicit knowledge which is known as externalization.

DEPLOYMENT IMPLEMENTING AND DOING:
At this phase, model has been finalized and can be implemented for a given problem which is known as the process of combination (Figure 1). As we can understand that deployment and application takes place once we confirm our planning for which we need an explicit knowledge. Thus there is a transformation from explicit to explicit knowledge which relates to the combination quadrant of the Nonaka model [7, 8] (Figure 1).

RESULTS MONITORING AND EVALUATING: (EXPLICIT TO TACIT)
As shown in the Figure 1, this process corresponds to the internalization quadrant. This phase includes transforming of explicit knowledge into the tacit knowledge. It indicates that how can we relate the present knowledge to monitoring and evaluation?

IMPROVEMENT IN LEARNING AND ADAPTING (TACIT TO TACIT)
During this phase we may desire to improve, learn and adapt tacit knowledge. This needs the conversion of tacit to tacit knowledge by the process of deliberations and Dialog which is only possible by learning and adapting processes.

VI. PRESENT WORK
Evolution of knowledge takes place in three dimensional environments during the application of factors like space, time, technology, management and human interaction. As indicated in the work of Harsh [13, 14, 18], knowledge is the function of time and space. Extra will be the time, extra will be the gathered knowledge by the organizations and therefore the space needed for the knowledge will be the more.
Technology can tend to play fundamental task in collecting, organizing and applying knowledge. Tools like Lotus notes, intranet and extranet are extremely helpful in re-organizing and using knowledge. Work of Joshi and Harsh [17] proposed that “as a result of improvement of reusability of knowledge in a specified technological leaning environment, not only improves the quality of software while it also enhances the output”. Joshi and Harsh [17] further clarified that “we should also account the effects due to time with the technology. Our new definition of technological knowledge may be more useful for a real organizations working in the software environments”. Thus time is a vital parameter because of technological progress with the time.
Present research too describes the space where the reusable components could be taken into account for the future reuse throughout learning practices. 
Job of human interaction with the technology and management gives extra space for better learning during knowledge management. As per the Figure 3, the institutions can relate the technology and knowledge management in an environment as administered by Nonaka and ADRI models. Present knowledge skeleton procedure under the revised Nonaka and ADRI models can be publicized to symbolize the qualitative picture of knowledge revolution.

VII CONCLUSIONS AND SUGGESTIONS:
Present work suggests that ADRI model can be considered within the framework of the well known Nonaka model of the knowledge management where tacit and explicit knowledge could be reused in the learning environments. Not only knowledge while data and information could also be reused in interactive learning environments where technology and human interaction play the significant role in a three dimensions.
Thus learning model of Piccoli et al. [19] along with ADRI and Harsh models (Jantti [6]) and Harsh [10-12, 13, 18] suggestions for extending Nonaka Model [7,8] can offer us a wide-ranging useful information about a three dimensional learning environment where technology and human interaction play a significant role in management of data, information and knowledge. This can be a great asset for student assessment of coaching.
Thus infrastructure of organization like technology, management tools etc. can also be reused in order to make system more qualitative. Moreover, learning environment can be varied by varying these parameters. Thus a framework for learning could be created where the desired reusable data, information, knowledge play vital role based on the Piccoli et al. [19] model.
In addition, reuse of software and its knowledge can be utilized to comprehend best solution during above learning environment. For this we have to create a system which permits efficiency of actuality which is cooperative in managing and reusing quality knowledge in diversity of different situations.

REFERENCES

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