

An Organizational Data Communication and Knowledge Creation via Object Oriented Model for Modern Businesses

Dr. Srinivas Nowduri

Department of Mathematics and Computer Science, Luzerne County Community College, 1333 Prospect Street, Nanticoke, PA 18634 USA
(snowduri@luzerne.edu/dnsrini@gmail.com)

ABSTRACT

An organizational data communication process and organizational knowledge creation process, are viewed from an object orientation perspective. The strong linkage between tacit and explicit knowledge, in modern businesses is found to be vital for the evolution of organizational knowledge. Proposed a new suitable knowledge conversion matrix, in creating an organizational knowledge. The pattern of organizational knowledge evolution processes, is more aptly compared with that of fountain model of an object oriented approach. Finally highlighted the role of tacit and explicit knowledge and their support to management information systems, while boosting the organizational productivity and quality.

Key Words: Organizational Knowledge, Management Decision Support Systems, Knowledge Representation.

1.0 INTRODUCTION

In this modern era, two broad areas viz., “data communication” and “networking” have been a vital area for almost all sizes of businesses in this modern era. The extract of “data” (which is “information”) has been playing a vital rule in the past and creating a separate area viz., information technology (IT). Most of the modern industries were slowly start depending on IT for their day to day business operations. This trend is continued and ongoing for the past several decades. Recently, the utilization and commercialization of “information” extracts (which is “knowledge”), become common in the corporate world, in the form of knowledge based systems (KBS). The idea behind “data communication” is in used to be in different forms through several computer networks like local area network (LAN), metropolitan area network (MAN) and wide area network (WAN). Whereas, the art of knowledge communication across the business organization is still in its initial stages. Knowledge is primarily originate in human mind and then transfer into

certain computer based systems, called KBS. The process and sequence of this knowledge formation and transformation is relating to an area “cybernetics”, which is beyond the scope of this research work.

Nowadays a business organization can be viewed as network of several inter-organizational communications, with specific goals and targets. In general, any knowledge based view of an organization possess two predominant goals viz., “generation” and “application” of knowledge [2]. Invariably, most of the modern businesses depends on several KBSs, for running and maintaining their businesses. These KBS exhibits some form of intelligence in providing needed support and service. These intelligent systems are carefully designed and developed, by certain dedicated people/ firms with an exclusive knowledge representation schemes. This is vital in order to exhibit business knowledge and intelligence required by that firm. In general, the “knowledge” which is mostly used in KBS design, can be broadly categorized as ‘tacit’ or ‘explicit’.

The “tacit knowledge (TK)” is highly personalized, and is both hard to formalize and to communicate. Therefore a TK can be defined as knowledge that has not yet been codified outside the mind of an individual or individuals that possess it. Undoubtedly this is intangible chunk “consists of knowledge which is difficult to express and to communicate to other people by means of any symbols [11]. In general, this TK is quite difficult to transmit when compared to codified knowledge [12].

Furthermore TK has a “personal quality”, which makes it hard to formalize and communicate” [9]. For example, the tacit knowledge might be the instincts and aircraft pilot who possesses, that give him or her, a free hand to gauge safety conditions by the physical feel of flight. Thus TK is a kind of knowledge that comes from personal experience and is difficult or impossible to communicate.

On the other hand, “explicit knowledge (EK)” can be transmittable easily in formal and systematic languages. There by EK can be codified and "is transmittable in formal and systematic language" [9]. Precisely speaking this EK consists of “knowledge which can be expressed in symbols, and which in turn can help to others [12]. To continue using the above example of a pilots, there exists always an operator’s guide or set of standard operating procedures (SOPs) for each type of aircraft. Thus a former and an active duty pilots always write the SOP, filling it with TK, now made explicit by the fact that has been written and shared. The use of an SOP and the language contained within the SOP are understood and accepted as standard among that particular community or group.

In a business organization, the employees are the most important assets. Thus, the employees’ work experiences, generated ideas and expertise are very much reflects in overall quality and productivity of the business. The amount of knowledge contained within the employee’s mind is of more worth to the organization, while improving its business processes.

Finally this knowledge can be measured and quantified based on how it (knowledge) has applied to daily business activities and dedicated process; eventually saves time, reduce costs, and advance the organization’s initiatives.

Hypothetically speaking, every business organization work in groups, keeping its employees TK as organizational knowledge base for their business. Thereby initially the knowledge evolve in human mind as TK, over a period of time, it transform and flow into computer based systems known as KBS. As this is clearly representable and editable, known as EK. One must note also that this EK is always, organizational (or business) specific, so is known as organizational knowledge (OK). This simple idea behind formation of OK is the main source for most businesses.

The “best case scenario” in this situation is quite straight forward, can be depicted as following:

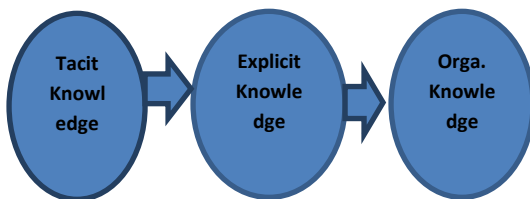


Figure 01: Transformation of Knowledge within Business Organizations

The above mentioned two links should be very strong, reflecting the peoples’ (employees) organizational commitment, results in best services and products. In this same vein, the “worst case scenario” can also be depicted and discussed in several ways. The reasons for this can be many such as lack of proper industrial trainings and workshops, business process improvements and initiations.

In variably a firm is a conglomeration of diverse employees with varied cultural and academic back grounds, but (forced to) work towards unidirectional viz., organizational mission and vision. All employees doesn’t possess the same level of TK. They have to work in group/team, helps converting TK as EK, to meet the business needs and targets. Broadly one can visualize the employees TK as three types:

- (A) Who join the firm with pre-stored working knowledge
- (B) Who acquire knowledge through organizational training and
- (C) Who (new recruits) gain knowledge merely by experience, over a period of time.

It is very difficult to enumerate amount of each of these three category of people towards the organizational value. Thus one can also define an OK as a combination of these various chunks of knowledge, (weather it is TK or EK). At the same time OK is also intertwined with the organizational business model and the associated business processes.

Some employees are of most importance for business. Since their generated ideas, past work experiences, and expertise (transformed in to OK) are very much useful for overall productivity.

This research primarily proposes and compares the evolution of OK as fountain model of object oriented (OO) paradigm. Eventually directs its attention towards the design and development of new KBS.

The research agenda in this paper is to visualize the knowledge creation process as a fountain model of object oriented model paradigm. The number of ways in encapsulating the logical network among the human knowledge and organizational knowledge creation.

1.1 LOGICAL LINK BETWEEN HUMAN & ORGANIZATIONAL KNOWLEDGE

Ever since human evolution and civilization have started, invariably there exists a strong bondage between human knowledge and OK while addressing several real world problems. These real world problems used to

address from the survival to societal usage. At the same time, the human knowledge, can be declared as combination of both TK and EK, is always dynamic by nature, keep evolve over a period of time. On the other hand the business organizational needs and processes are also volatile, needs constant update, according to the customer demand. This clearly shows there is a need or demand for human knowledge, to be applied or transformed on each of the organizational business activities. This strong bondage between human knowledge and OK makes up strong societies, creating corporate sector with competitive businesses and markets.

The basic difference between human knowledge and OK lies precisely in their underlying “thinking process”. The field of “cybernetics” throw more light on this connectivity, which is outside the scope of this research. Most of the existing world situations, are invariably tied up with “events” and their application to real world problem solving. This gives huge scope for exploring human knowledge further according to the event’s initialization, associated procedure and finally the output of an event. For example, the design of a modern mobile phone, or the design of a modern applets (apps), draws the knowledge of a real world problem solving, coupled with technical or programming details [5][7]. On the other hand, OK is precisely a combination of several individuals within a group/team making certain assumptions and projections for future demand of that product? For example, most of the cloud computing applications are associated with storage, usage and retrieving of data by individual organizations.

In this modern era, the inter dependency of human and OK is very much coupled with market scope and demand, giving a wide scope for OK to explore further. Undoubtedly OK is very much tied with specific product or business process, specific to an organization, leaving no scope for generalization. Thus OK needs to be generated, stored, upgraded and managed, strictly subject to a firm’s vision and mission.

The logical network between the human knowledge and the organizational processes starts with basic emphasis on skills needed towards certain business tasks, via (if needed), organizational training needs. Most of the times this specific logical link is not unique, as shown below, due to the volatile nature of the human knowledge associated with different level of the employees.

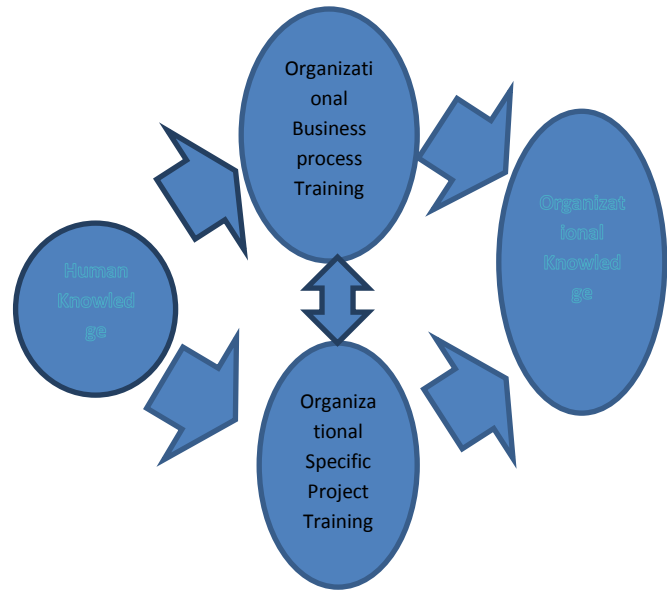


Figure 02: Logical network across human knowledge and organizational knowledge

In this model, the most vital and difficult part is the inter-connectivity, as they involve and evolve from several in-built human psychological issues, fall within the “cybernetics” filed. This strong bondage also reflects on the organizational quality and productivity.

The most important asset for a business organization are its employees. The conversion of human knowledge into OK is in two ways viz., “deductive” (where logic goes from general to particular) and “inductive” (where logic goes from particular to general). Therefore the business firms start allocating resources and time towards fine tuning their intake employees towards training and work-shops about their business processes and activities in the name of orientation or business process trainings.

Before we go further into the details of this human knowledge and OK let us first investigate what is knowledge and its various forms, in view of its applicability towards modern business organizations.

1.2 AN OVER VIEW OF “KNOWLEDGE” AND ITS DIFFERENT FORMS

Knowledge is defined as a refined version of information, confined to a particular area/product/process. Human acquires information in his/her schooling/college in the form of principles and formulas. Latter at work place, apply these in the form their knowledge, while addressing the organizational needs and activities. This logical conversion mechanism makes him/her fit into a work place.



The significant point here is: The information acquired in school or college is “general” outlines of principles and practices needs to be converted towards a “specific” business application. By default this is a quite natural process. One should remember that this acquired knowledge is purely a tacit knowledge (TK) and cannot be represented. Once we apply this knowledge to an organizational specific project, it is forced to convert into a more representable scheme, which is then called explicit knowledge (EK). Organization work in groups so this EK is a combined version shared from several individuals’ TK. In general this is a true and justified within the given organizational activities.

The past literature on traditional epistemology defines knowledge as a "justified true belief" [9]. This clearly shows that the TK needs to be justified in order to bring its application to real world problem solving. Purely from an information system’s perspective knowledge can also be defined as information that has been put into a particular (business or scientific) context. Sometimes this conversion is even through application of personal experiences. Eventually this converted EK becomes become a valuable or an asset to an organization.

Before we investigate the origin of knowledge creation by an individual or institutions, let us first review the two primary definitions of tacit and explicit knowledge.

1.2.1 INDIVIDUAL KNOWLEDGE

Individual knowledge can be defined simply as knowledge possessed by a single person. This knowledge is most often is considered as that individual’s TK. This individual knowledge, remain individual, as long as it is not share to others. The movement it is shared, it is considered as an explicit knowledge, That is, once it is published as a document, in a journal or a book.

An individual knowledge can be acquired through personal experience. At times it can be acquired without any specific language. For example, apprentices work with their mentors and learn craftsmanship not through language but by observation, imitation, and practice. In a business setting, on-the-job training (OJT) uses the same principle." [9]. In the case of OJT, an individual is acquiring knowledge from observing another person’s actions, and once the individual applies his or her own experiences and background to what is learned it becomes individual knowledge. Thus literatures says that creation of new ‘individual’ knowledge derived from observation, imitation and practice is known as socialization or tacit knowledge sharing.

Sometimes individual knowledge can also be developed from an explicit knowledge. For example, what a person reads, can contribute to new thoughts and ideas in the mind of that individual. This method of knowledge creation is referred to as internalization – turning explicit knowledge into tacit knowledge. At times by reading/acquiring explicit knowledge, a person’s independent thought and analysis can develop into new, individual knowledge.

Overall an individual can make a greater contribution to the knowledge sharing and creation process by allowing their knowledge to be internalized by others or socializing their knowledge with others, which leads to the creation of group knowledge. This is a very valuable asset to modern corporate world.

1.2.2 GROUP KNOWLEDGE

The field of social psychology “a group is defined as 'a dynamic whole based on interdependence rather on similarity'" [9]. Group knowledge is defined as individual knowledge that multiple individuals rely upon as truth, share and understand. Group knowledge is “broadcast information” [Corrêa da Silva & Cullell, 2003], but is not necessarily information shared ‘publicly’ (i.e. “common knowledge”). While group knowledge is shared, it remains contained within community of practice, a subunit, or other group or team of individuals who share tasks, or common or related functions. Further it is not the aggregation or multiplication of individual interpretations, but the synthesis (of those interpretations) which leads to group knowledge" [10].

It is also possible that a group knowledge can be generated and disseminated through socialization. This is often results in the transformation of TK into EK, known as externalization. When groups come together and exchange ideas, “individual knowledge is synthesized to arrive at group knowledge, which eventually becomes routinized at the organizational level. Thus, the transformation of individual knowledge into organizational routines leads to complex and embodied OK" [10]. This form vital base for modern competitive market.

1.2.3 ORGANIZATIONAL KNOWLEDGE

One of the characteristics of an OK, is its dynamic nature and volatile nature; according to prevailing market conditions and customer demands. In business forms, the group knowledge from several subunits or groups is combined and used to create new knowledge.



This results in TK and EK, can also be called OK. This is because, an organizational learning is seen as encoding inferences from history into routines that guide behavior [11] [12]. Thus OK is an end product of those several routines designed and defined by management. For example, again using the Navy as a point of reference, during and after major combat operations, lessons identified across the organization are usually captured in a formalized system and assigned to the appropriate offices of primary responsibility (OPRs) for action. Finally by sharing those lessons explicitly across all groups, OK is created.

Therefore the process of reviewing those lessons and providing responses that in effect change process routines already in place in a way that improves the performance of the organization or speeds decision processes constitutes organizational learning.

Furthermore, at an organizational level, new knowledge is also generated by combining explicit knowledge with explicit knowledge. A command-wide standard operating procedures guide, comprised of SOPs developed by various groups within the organization is an explicit form of “combined” knowledge. “Organizations continuously create new knowledge by reconstructing existing perspectives, frameworks, or premises on a day-to-day basis.” [9].

OK becomes particularly powerful and measurable when combined knowledge is used create standard routines, create a common culture and language, and encourages and enables cross-functional group interactions within an organization. It is in the interest of the organization to develop its individual and group knowledge sources, to expand their organizational knowledge base.

In case if a business organization does not possess the knowledge it needs, then what are the ways of gaining a competitive advantage, is still an open question to many. In such situations, a common business strategy is to involve by introducing an extra-organizational knowledge into the organizational knowledge creation process. This is not that straight forward, but it is possible. There comes working knowledge in handy, a form of OK.

1.2.4 WORKING KNOWLEDGE

Working knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It

originates and is applied in the minds of knowers. This working knowledge is always shared in the name of “orientation training” for newly joined employees. In organizations, this working knowledge is often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.

In all business organizations, such working knowledge is initially tested thoroughly, evaluated and surviving structure of information (e.g., DNA instructions, synaptic structures, beliefs, or claims) that is developed by a living system to help itself solve problems and which may help it to adapt.”

1.2.5 EXTRA-ORGANIZATIONAL KNOWLEDGE

In any society, the corporate world has witnessed, communities of practice that start extending beyond organizational boundaries. That means creation of an extra-organizational communities of practice are precisely linked by what they do rather than where and for whom they work for [4] [13]. The knowledge generated from exchanges between similar communities of practice from different organizations constitutes so called extra-organizational knowledge [5]. Professional organizations or societies host luncheons and hold conferences on topics of interest to like functioning communities of practice. Journals on shared topics of interest are published as means to capture and share extra-organizational knowledge. Explicit extra-organizational knowledge is particularly valuable if an organization is missing an internal capability or group knowledge base. Expertise and knowledge created by other organizations can be used to fill deficiencies within an organization and add to the value of organizational knowledge.

Now that we understand the types of knowledge available to an organization, we will review intellectual capital, define it, and attempt to assign value to the intangible.

1.3 FOUR MODELS OF ORGANIZATION KNOWLEDGE CREATION

The idea of organizational knowledge creation (OKC) can be at best described as a “model”, for various reasons. First it forms a basis for the development of a commercial product or a service. Secondly, this organizational knowledge creation is a continuous process, within business organizations, across its



various departments. Third the organizational knowledge creation is dynamic by nature, with its constant shift from one form to other. Finally it provide a solid base for organizational employees' professional growth. The past literature clearly states that there are four models of organizational knowledge creation [9] [6] as following:

- A. Externalization Model: This model converts tacit knowledge into explicit knowledge. This is most common mode of OKC where every individual knowledge is transformed into OK, at work places.
- B. Internalization Model: This model combines explicit knowledge into tacit knowledge. This is a model where human learn at work places, through organizational training, during initial days of their inception.
- C. Socialization Model: This model converts tacit knowledge into tacit knowledge but at an individual level. Most of the modern organizations are start adopting this model in recent era. This involves, using of, social networks like face book, twitter and skype.
- D. Combination Model: This model converts explicit knowledge into explicit knowledge at an individual level. This is a rare model among the all, here the input being partly "explicit" as well as "implicit" knowledge. This model is more suitable to scientific experimentation, rather than business.

With these well designed models, one thing is clear that the knowledge is keep changing or transform rapidly from one form to another. This resulted knowledge invariably coupled with respective business processes and contribute towards better productivity and quality.

Table1: Table of possible knowledge conversions

CONVERTS	TACIT KNOWLEDGE	EXPLICIT KNOWLEDGE
TACIT KNOWLEDGE	MODEL SOCIALIZATION	MODEL EXTERNALIZATION
EXPLICIT KNOWLEDGE	MODEL INTERNALIZATION	MODEL COMBINATION

The conversion from Tacit to Explicit is of four types detailed through the above proposed Table 03 "conversions matrix". The amount of knowledge conceives and converted from one type to another results and remain in the form products or services, within the business organizations.

This above matrix conversion is clearly conclude or inferring the following facts:

1. There are FOUR types of conversions impacting our society and business environment: Tacit to Tacit (T-to-T), Tacit to Explicit (T-to-E), Explicit to Tacit (E-to-T) and Explicit to Explicit (E-to-E).
2. T-to-T is quite common in nature, most of the existing social networks such as Facebook, twitter come under this category. T-to-E is what one learns right from kindergarten to University. E-to-T is basically implemented in work environment, making a person more and more valuable (or resourceful) employee for the organization. Finally E-to-E is very rare transformation, does exists only in some special circumstances such as organizations take over
3. Both tacit knowledge as well as explicit knowledge constantly and continuously needs to be convertible at an organizational level while creating "organizational knowledge", which eventually becomes organizational proprietary.
4. The "tacit knowledge" being highly personal and hard to formalize, so its conversion to "explicit knowledge" is easy.

2. BUSINESS ORGANIZATIONS AND THEIR INTELLECTUAL CAPITAL

The employees and human capital is often recognized as an organization's greatest assets. The abundant supply of goods and services are on the markets has made challenges to all types of modern businesses. In order to emerge as a market leader, in the competition, more specifically, the information and knowledge contained in the mind of the individual is of particular value. Some of that knowledge can be made explicit, while some knowledge will inevitably remain tacit due to its "personal quality" [9].

By one definition, "intellectual capital is a term with various definitions in different theories of management and economics. Accordingly, its only truly neutral definition is as a debate over economic intangibles'. Ambiguous combinations of human capital, instructional capital and individual capital employed in productive enterprise are usually what is meant by the term, when it is used to actually refer to a capital asset whose yield is intellectual rights" [2][5]. Knowledge, regardless of its source, can therefore be considered 'intellectual capital' because of its economically 'intangible' nature. Understanding that knowledge is valuable is one thing, but quantifying its value is a challenge unto itself.

The next obvious question in the picture is to look for origin and propagation of this knowledge, within business organizations. In this modern era, with an exponential growth towards the competitiveness and business processes, this organizational knowledge is making a marginal differences, in creating, manipulating and storing business processes and strategies. The next section gives us a clue of origin and for propagation of this organizational knowledge.

3. “KNOWLEDGE CREATION” AS AN OBJECT ORIENTED MODEL

An organizational knowledge is basically stems from its employee’s quality and knowledge level. Its assessment and evaluation is itself a broad topic of research, is beyond the scope of this research work. As it involves diversity, different cultures and experience levels, it is very difficult to design any standard model, which fits to model industrial world. At the same time, an object oriented programming (OO) paradigm addresses the issues transforming the given problem to its solution. Here the main concept is to look at the overlap and merge several activities across the software development life cycle. As knowledge is always created

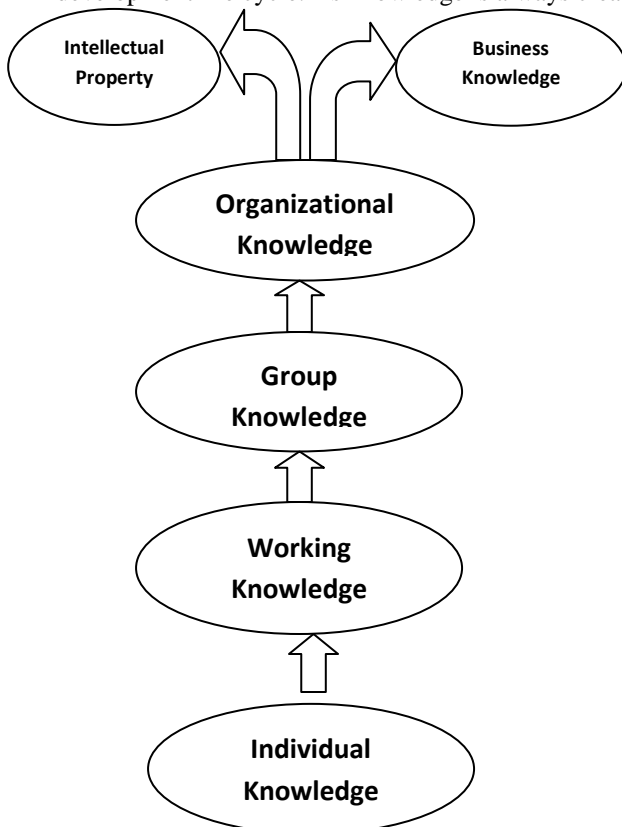


Figure 04: Fountain Model of Organizational Knowledge

and upgraded, one need to view ‘software’ as a main source for any computer based system, which manipulate, communicate and control the entire organizational business activities. These software needs to be upgraded time to time when new organizational data.

As mentioned earlier, the organizational knowledge creation is a typical bottleneck issue for several business organizations in this modern era.

We propose the following knowledge creation model, as shown in Figure 04 above, encompassing several challenging issues (which are beyond the scope of this research) like, (A) industry-academic map, (B) modern market trends and analysis and (C) rapid changing

technological advancements. In this work we are briefly cut shorting our discussion to our proposed model and its impact on modern industrial growth. A standard object oriented model (or fountain model, as against to waterfall model) clearly indicates the lowest level to be an object oriented analysis (OOA), followed by object oriented design (OOD) and object oriented programming (OOP), can be described briefly as shown below. This standard model is dominated the industry from several outstanding perspectives such as reusability, inheritance, polymorphism, etc.

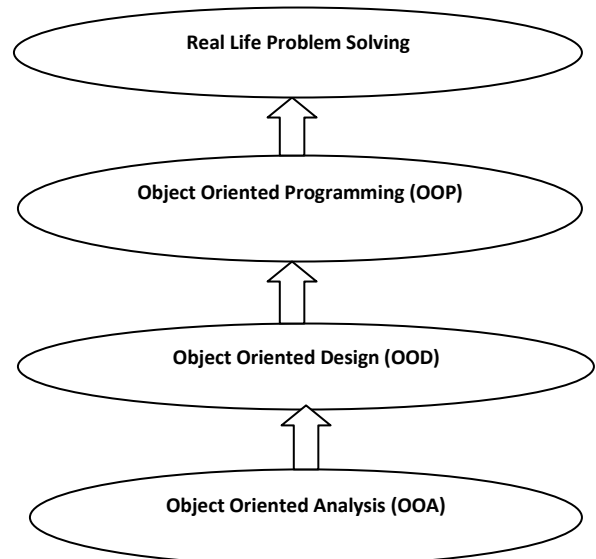


Figure 05: Fountain Model of OO Paradigm

This above shown in Figure 05 model is also applicable for incorporating Web technology, E-commerce, commerce technology and cloud computing, which are prevailing in today’s competitive market.

4.0 THE REAL VALUE OF AN ORGANIZATIONAL KNOWLEDGE

How does an organization assign value to its knowledge and quantify the knowledge assets in its possession? Doing so requires identifying a method or methods by which intellectual assets can be evaluated. Daniel Andriessen attempted to identify a methodology for measuring the intangible, identifying knowledge as the first of seven “characteristics” of the “intangible economy” [1]. According to Andriessen, “a value reflects the concept an individual or group has regarding what is desired. It serves as a criterion to determine a choice from existing alternatives” [1].

Past literature on this topic, also identifies four methods for determining value. First, the financial valuation method, which assigns monetary value to an object. Second, the value measurement method, which involves using a non-monetary criterion and translating it into an observable phenomenon. Third, the value assessment method, which is dependent upon the personal judgement of an evaluator. Finally if the framework does not include a criterion for value, but does involve a metrical scale that relates to an observable phenomenon [1] [3] intangibles can be measured by what he calls the measurement method.

How an organization chooses to approach measuring the value of organizational knowledge might depend on the source of the knowledge or on how that knowledge might help meet a current objective. For example, certain groups within the organization might share knowledge that directly affects spending, and if the organization’s objective is to cut unnecessary costs for a certain period, the organization might require its groups or subunits to perform an assessment of software products in use.

In case after reviewing the results of the assessment the organization can identify that three subunits are using three different software products that provide the same or similar services, they may decide to select one product to use organization wide, reducing costs by the number of dollars expended on the upkeep and licensing for the other two products. In this case the financial valuation method would apply.

The value measurement method might be used to assign value to organizational knowledge if the knowledge held has an observable effect and non-monetary criteria. Perhaps making a practice of knowing and then celebrating special events or milestones in an organization will positively impact morale, so much so

that the changes and positive or negative impacts are observable among the staff. The value assessment method might be applied in situations where a leader, manager, or commander is able to evaluate the immediate value of organizational knowledge. In the commander’s case, perhaps having access to organizational knowledge allows him or her to make a critical decision more quickly and easily. He or she can then make an assessment based on the results.

Finally, organizational knowledge or extra-organizational knowledge acquired might give and organization a competitive advantage in an advertising campaign. The success of that campaign can be measured on a numerical scale and perhaps be observed if the campaign contained a tag line that becomes part of common language and culture in the general public. In this case, the measurement method might be used to assign value to organizational knowledge.

Ultimately, the ability for an organization to be agile, successful, improve performance and positively impact its internal culture will determine the true value of organizational knowledge to the organization.

5.0 CONCLUSIONS AND FUTURE POSSIBILITIES

As organizations evolve into more effective and efficient knowledge creators and knowledge consumers, we may expect to see a rise in the number of studies that focus on how to best measure the value of knowledge as an intangible asset. After all, the effects of knowledge management efforts should be measurable as knowledge management itself requires an investment of time, resources and manpower.

In this modern era, this evolution of organizational knowledge can be compared with that of an OO model to sustain the businesses, for long term viability. At the same time, the business organizations will continue to create their own frameworks for valuation or be able to rely on a common methodology for such measurement regardless of the type of organization doing the evaluating.

Data communication and knowledge creation both are sustainable only if we follow a long standing approach like OO’s fountain model. Either way, it will be important to observe the impact of improved organizational knowledge and knowledge management practices to the value of an organization, its people and organizational success and sustainability.



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