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Knowledge management from Theory to Practice. A road map for small and medium sized enterprises

Yuan Wang

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Abstract:

Nowadays, business activities become more and more complex; they entangle numerous aspects of knowledge: legal, financial, management, information technology, and so on. Knowledge Management, a still novel solution for most organization, aims boost and optimize the knowledge transfers in organization. The thesis is about should and how small and middle medium enterprises apply knowledge management. The author argues the content of knowledge management, and how implements those ideas into real business environment.

Keywords: Knowledge Management, Small and Medium-sized Enterprise (SME), Enterprise Content Management (ECM), Workflow management, and Collaborative Support Software.

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(Those figures without any references are created by the author)

Chapter 1 Introduction and Motivation

In the last several decades, numbers of concepts related with the term *knowledge* have emerged. Such as Intellectual Capital, Knowledge Worker, Knowledge Transfer, Organizational Learning, Knowledge Economy, Knowledge-based system and etc. These phenomena clearly show a fact that knowledge is considered as valuable assets and resources of today's enterprise. But do enterprises of today have capability to manage those resources? Do they need an information system to support them on management? Is it necessary to design a program called knowledge management (KM) for managing resources of knowledge? Just like supply chain management deals with resources of suppliers, while customer relation management (CRM) deals with customer information resources, it is necessary to tailor a KM system, what should a KM system include? What kinds of organizations need KM? There are not yet clear and reliable answers to those questions yet in terms of academic research.

Notwithstanding these questions, there are many organizations, including some Small and medium sized enterprises (SME), are tailoring their own KM programs. A Greek mythological metaphor may intuitionally explain their situations. An organization which is carrying on KM programs acts as the Argonauts, a band of heroes carried by the Argo ship. This risky KM project can be considered as a labyrinth. The aim of this KM adventure, which represents the golden fleeces from the Greek story, is to gain more competitive advantages. Though this analogy is not perfect, it at least delivers out some information, that one KM project could be very risky especially for SME, and that organization should be considered as a band of heroes, who have their own skills, knowledge and from diversified background when considering the social-cultural part of this adventure.

Why does the author describe KM as the labyrinth? What is the Minotaur in this maze? The theoretical and technological immaturity of current Knowledge Management is part of the answer. For instance, the value of KM is still under the debate among informatics schools. Some scholars still think that KM is part of the so called *management fashion*. Further, a knowledge management project even entangles organizational culture and organization behavior issues.

When KM has been adopted by SMEs, things are becoming more complex. Unlike large organizations, SMEs usually do not have technology nor finance leadership position, which can greatly support KM program if they were in such position. In other words, they face greater challenges, because it is unreasonable for SMEs to follow the trace of large organizations' Knowledge Management programs. Instead, SMEs should have their own roadmap in this

labyrinth. This roadmap should consider their pros and cons for planning and implementing knowledge management program.

1.1 Research objectives and questions

The ambition of the thesis is to design a feasible and holistic Knowledge Management solution roadmap for small and medium sized enterprises. This roadmap must be ‘pragmatic, yet theoretically sound’ (Zack, 1998). Unfortunately, it is not easily to achieve at the theoretically sound level in current Knowledge Management field, where full of debate and doubt. Therefore, a conceptual analysis on Knowledge management theory is essentially necessary. First of all, the author needs to proof that Knowledge management is feasible and useful. Further, the author should answer what a knowledge management system includes. And then the author would also analyze that why small and medium sized enterprises need knowledge management. The main focus of this thesis is to design a Knowledge Management roadmap that guides small and medium sized enterprise to Knowledge Management implementation. This roadmap should cover both technological and business aspects in order to be feasible. In the technical part, the author will select the existing techniques to implement the knowledge management system model.

This thesis will answer to the questions as below:
What is Knowledge Management?
What are the business initiatives of knowledge management?
How actually can Knowledge Management contribute to organization?
How to implement Knowledge Management nowadays?
Should SMEs (small and medium sized enterprise) take on KM (Knowledge Management) solution? If yes, how should knowledge management be taken on?

The author divides the research objectives into 2 phases. In the first part, the author will outline a theoretical knowledge management system model, including all the essential factors of organization environment. The second phase is to implement this model into a real SME business environment. Obviously, the first objective is the foothold for the second one.

1.2 Relevance and Significance

1.2.1 Why study Knowledge Management

Knowledge management area lacks of a holistic picture, Thomas, J.C, from IBM, describes “knowledge management as a puzzle” The author attempts to put all important pieces of this puzzle together and deliver a clear and deeply understanding on knowledge management.

1.2.2Why SEM

According the data from European Commission, SMEs represents 99% of all the enterprises in EU and provides around 65 millions jobs. It is beyond doubt that SMEs are both socially and economically important. Just like large organizations, SMEs also needs Knowledge Management in order to be more competitive.

However, small and medium sized enterprises face serious challenges when taking Knowledge Management, since SME has neither technical nor financial leadership. Currently, Knowledge Management research mainly focuses on large organization. This thesis attempts to full the blank.

1.3 Structure of the thesis

The Chapter2 is about the methodologies which employed in this thesis. The Chapter2 includes the argumentation about choosing those methods, and the possible better combination of methods.

The purpose of the Chapter3 is to construct a holistic Knowledge Management system model rather than to simply introduce theoretical background. In this chapter, the author will critically review many essential Knowledge management concepts. The purpose of this part is to hold a better understanding about Knowledge Management.

The Chapter4 and Chapter5 are about implementation of theoretical knowledge management model from previous chapters, with Chapter4 from business planning aspect, and Chapter5 from technical aspect.

The chapter6 is an empirical work. The author applies the previous ideas in a real company.

The Chapter 7 concludes previous studies, and recommends further studies in this subject.

1.4 Delimitation

In empirical work, it seems like a project proposal. Due to limited time and energy, the staff surveys are not taken.

Chapter 2: Methodology and Design of the research

This chapter describes how the author designs this research and chooses the methodologies. As mentioned in section 1.1, there are two phases in this research: theoretical modeling and practical implementation. The author will apply different sets of methodologies for each one.

2.1 Research approaches

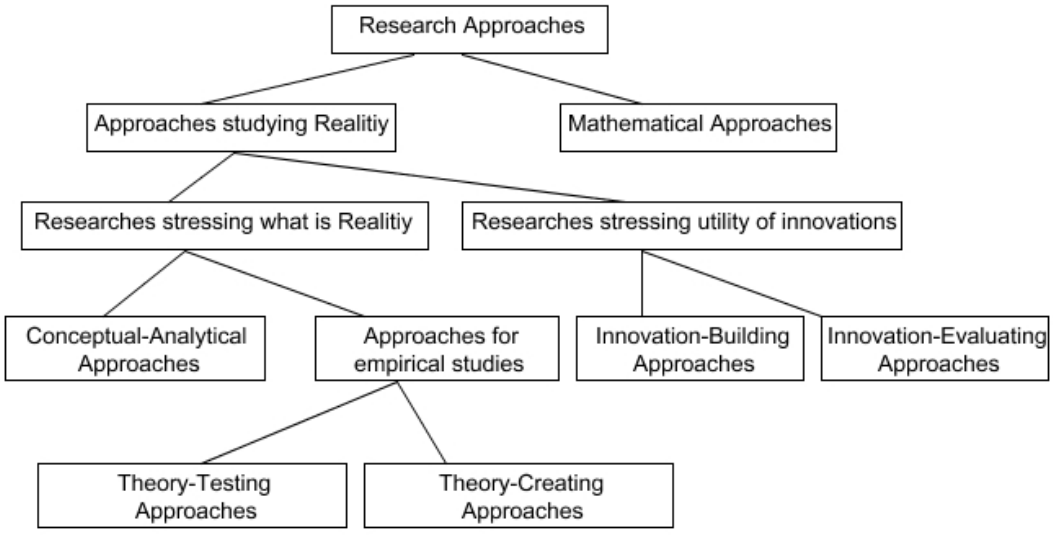

Figure 2.1 Järvnen's taxonomy of research methods

According Järvnen's taxonomy of research methodologies, there are 6 research approaches introduced: Mathematical Approaches, Conceptual-Analytical Approaches, Theory-Testing Approaches, Theory-Creating Approaches, Innovation-Building Approaches, and Innovation-Evaluating approaches.

Among those methods, Conceptual-Analytical approaches, and theory-creating approaches are employed in the first phase research. According Järvnen's explanation, the aim of Conceptual-analytical approaches is to abstract the reality into theory model or framework. Theory-creating approaches are how to systemize the concepts, relations between them, depict into a particular framework.

The author took a literature survey, selected relative articles. Just like Forbes's statement (2000), most researches are based on readings; the author collects the important, influencing theories and definitions in knowledge management

theory domain, and critically analyses on them, distill the essential and accurate parts among them. The conceptual-analysis approaches are invoked. The author creates his own ideas on the subject. By ‘gluing’ and integrating all the thoughts and balance all the factors, the author builds up his own theory on knowledge management. In this step, the theory-creating approaches are used. The information system research framework (see figure 2.2), introduced by Hevner et al 2004, deeply enlightens the author. The author will apply this framework for build a comprehensive Knowledge Management model.

In the second phase, implementation, the author will apply innovation-Building Approaches, which is about how to create some new techniques or artifacts. Besides, the author did an empirical work of this thesis as the theory-testing approaches. He applies the strategic planning and theoretical model into a real enterprise. Interview method is used in case study. A deep interactive discussion with one of the enterprise’s senior managers is taken place. In this practice, the author discovers some issues about previous studies of thesis.

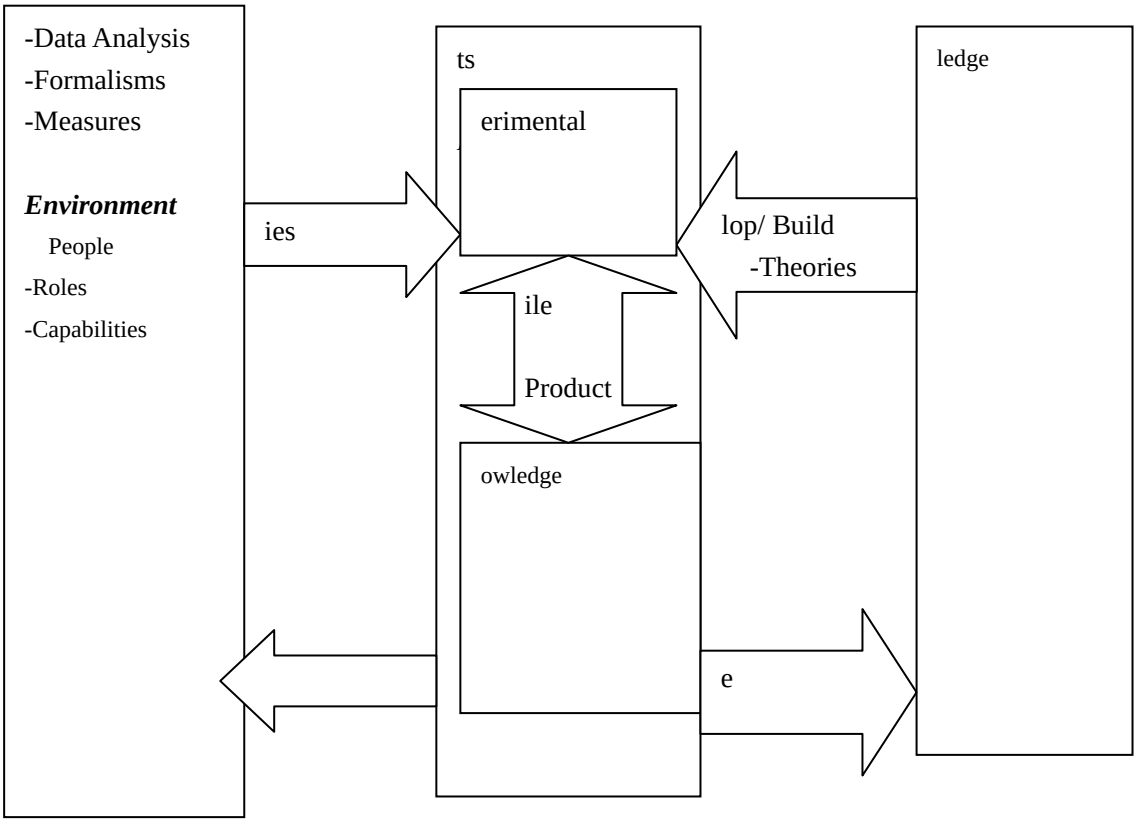

Figure2.2 Information Systems research framework Hevner et al.2004

2.2 Reflection and Conclusion

There are also many other possible approaches for this research. When the author works on the first phase, it would be nice if he contacts with some scholars in KM field, ask of their opinions about the author's model, a deep interactive communication is better than digesting their ideas from reading professional works. A search or survey on how SMEs are taking knowledge management also would improve the work. Studying on different industry would make the result more representative and comprehensive.

Studying this kind of new areas, pragmatism is one of the best compasses. The opinions and comments which come from business and administrant aspects are always helpful and informative.

Chapter 3: Conceptual analysis on Knowledge Management theories

Knowledge management domain is neither a classic nor mature area. There are not many well-accepted concepts existing, but actually nearly every model and theory is challenged by others. In order to put all essential puzzle prices of knowledge management theories into a holistic system, a conceptual analysis of existing theories is extremely important.

3.1 Knowledge

There are many schools and scholars claim knowledge management is not feasible at all. In their point of views, knowledge management is so-called 'management fad'. T.D. Wilson (2002) even states: knowledge management is a utopian dream. Their arguments are based on the nature of knowledge. They argue knowledge is fuzzy, contextual, embedded. Therefore, knowledge can not be managed. Is this statement true? The conceptual analysis on the term 'knowledge' may reveal the answer.

In this section, explore on knowledge follows two fundamental models known as DIKW chain and Nonaka and Takeuchi's SECI model in knowledge management theory.

3.1.1 DIKW chain model and the Nature of Knowledge

DIKW chain, also as known as DIKW hierarchy, has been accepted and gaining popularity in informatics field. Following diagram (Figure3.1) illustrates the relation among data, information, and knowledge.

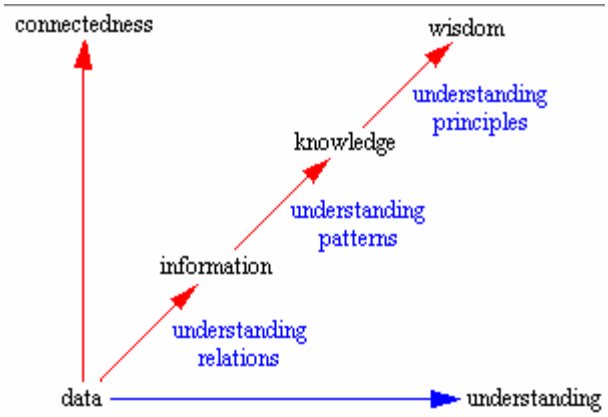

Figure3.1 DIWS Chain (Image originally published in 2004, <<Data, information, Knowledge Wisdom>> by Gene Bellinger et al. available at http://www.systems-thinking.org/dikw/dikw.htm)

According this model, Data is set of symbols; it records facts, statements, measurements, and statistics. (Ackfoll, 1989; E. Turban & Jay E. Aronson, 2001; McFadden et al., 1998) when there is a sound relation between data, information will show. Information is defined as organized or processed data that are timely and accurate. (E. Turban & Jay E. Aronson, 2001; Watson, 1998). Information should provide the answers about 4W: 'who', 'what', 'where' and 'when'. (Gene Bellinger et al, 2004) After finding the pattern between information, knowledge will show. Knowledge represents a pattern that connects and generally provides a level of predictability and actionable suggestion. Knowledge should answer questions of 'how' and 'why'. (Efraim Turban & Jay E. Aronson, 2001; Gene Bellinger et al, 2004). The issue about wisdom is beyond this topic, so it will not be discussed in order to avoid further confusion.

The intention behind this model is to distinguish among the terms data, information, and knowledge. Further, by this model, some scholars want to prove that transfer among data, information, and knowledge is feasible, even clear.

Unfortunately, this attempt is not so successful. This model barely instructs people on extract knowledge from information or data. The boundaries among data, information, and knowledge are still ambiguity. Terms like "understanding", "relation" and "pattern" are difficult to deal with.

Robert D. Galliers and Sue Newll (2001) also attempt to identify characteristics of data, information, and knowledge, (See Figure 3.2) though their purpose is to disprove the feasibility of Knowledge Management.

Data	Information	Knowledge
Explicit	Interpreted	Tacit/embedded
Exploit	Explore	Create
Use	Build/construct	Rebuild/reconstruct
Accept	Confirm	Disconfirm
Follow old recipes	Amend old recipes	Develop new recipes
No learning	Single-loop learning	Double-loop learning
Direction	Communication	Sense-making
Prescriptive	Adaptive	Seminal
Efficiency	Effectiveness	Innovation/redundancy
Predetermined	Constrained	Flexible
Technical systems/networks	Socio-technical systems/networks	Social networks
Context-free	Outer context	Inner context

Figure 3.2 Key Characteristics of data, information, and knowledge (Image originally published in 2001, <<Back to the future: form Knowledge Management to data management>>, the 9th European Conference on Information systems, Bled, Slovenia, June 27-29)

However, ignoring the contribution of DIKW is problematic. According this comparison, people may have a better understanding of Knowledge. Context and content generate difference among data, information, and knowledge, rather than physical measurable format or standard. In most cases, Knowledge is embedded in the overwhelming amount information and data. Knowledge is not obvious as data is; Knowledge contains uncertainty. Expression of Knowledge contains redundancy, complexity and ambiguity. Besides in materialized documents, Knowledge also exists in loose structured social network, in people's minds. Further, Knowledge acquisition requires human interpretation. Learning is cognitive, mental process.

3.1.2 Knowledge transfer and SECI model

Tacit and explicit knowledge, the classic taxonomy about knowledge in knowledge management domain, was first introduced by Polanyi in 1966. Tacit Knowledge is held by individuals, and located in their minds. Tacit Knowledge is subject, subconscious. Tacit knowledge is ephemeral, especially for organizations since the members within an organization are with mobility and they are acting dynamically. Yet, explicit knowledge is materialized, codified, and conscious (documents, policies, norms, and products).

This division perfectly explains how knowledge transfers. It can be considered

as the most important contribution of this concept.

T.D. Wilson in his famous article <<The nonsense of 'Knowledge Management' >> claims ''Knowledge involves the mental processes… that go on in the mind and only in the mind…Whenever we wish to express what we know, we can only do so by uttering messages…Such messages do not carry 'Knowledge', they constitute 'information', which a knowing mind may assimilate, understand, comprehend and incorporate into its own knowledge structures.''

By applying the tacit and explicit knowledge concept, Knowledge transfer process can be clearly explained. The following diagram (Figure 3.2) illustrates the process.

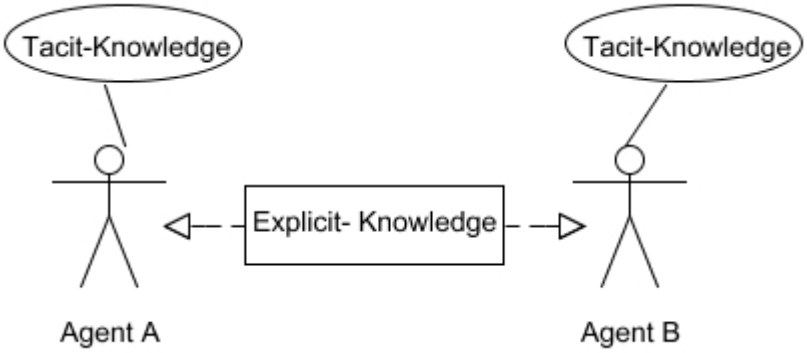

Figure 3.3: knowledge transfer

This principle of this process is similar with the popular communication model: Sender->Encoding->Signal->Decoding->Receiver. As same as the communication model, the noise and distortion exists in knowledge transfer. There are other 3 types of transfer: Tacit to Explicit (see figure3.3); Explicit to Explicit (see figure3.4); Explicit to Tacit (see figure3.5).

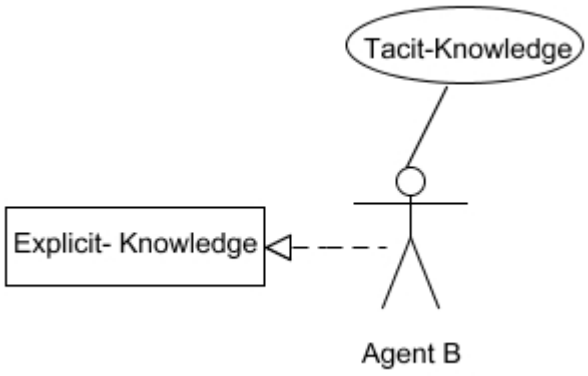

Figure 3.4 T2E knowledge transfer

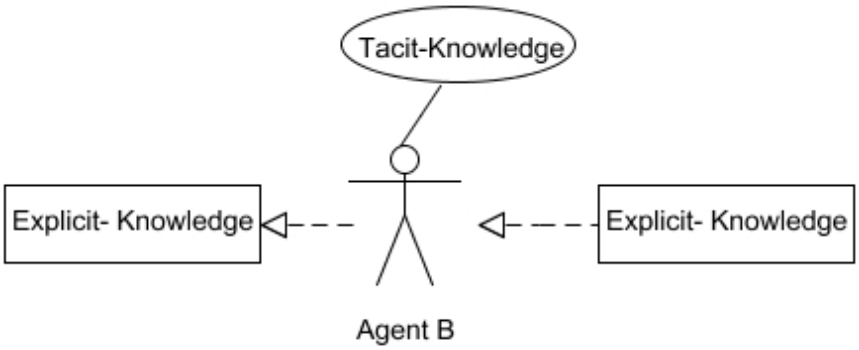

Figure 3.5 E2E transfer

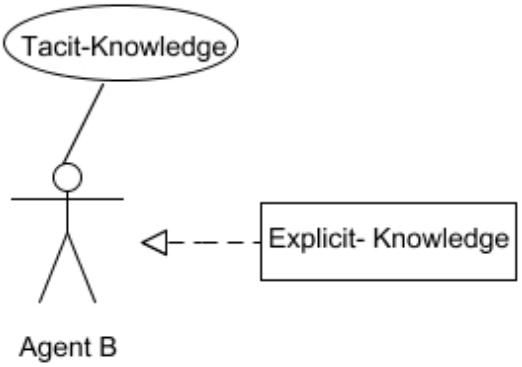

Figure 3.6 E2T transfer

Base on those 4 types transfer, Nonaka and Takeuchi (1995) reformulated the 'Tacit and Explicit' distinction, as known as SECI model (Figure3.6). They argue Knowledge management program is to improve those knowledge transfers.

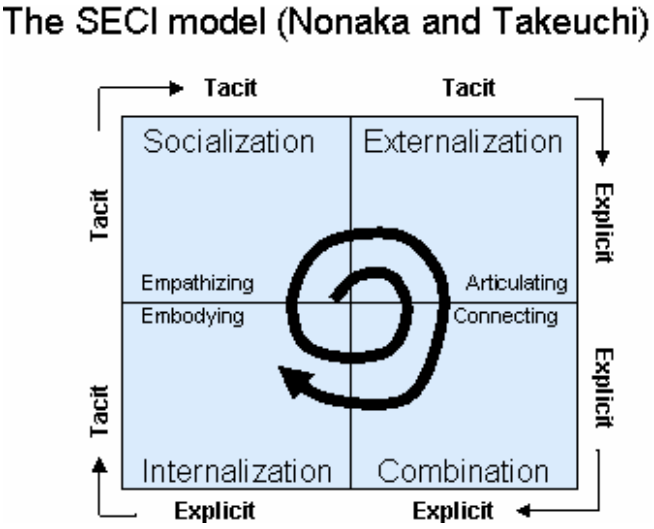

Figure 3.7 SECI model (Image originally published in 2007, <<SECI model>> by Tom De Geytere, available at http://www.12manage.com/methods_nonaka_seci.html)

Socialization: the tacit to tacit transfer, refers sharing tacit knowledge through

social communication, such like apprenticeship, brainstorming.

Externalization: tacit to explicit transfer, refers materializing the tacit knowledge into explicit, such like documenting.

Combination: explicit to explicit transfer refers combining of various elements of explicit knowledge. For example: Prototyping.

Internalization: explicit to tacit transfer refers learning from explicit knowledge, reading documents or studying the prototypes.

Nonaka and Takeuchi also classify enterprise knowledge into four categories (see figure 3.8): and they are experimental knowledge assets, conceptual knowledge assets, and systemic knowledge assets. Both Experimental and Routine knowledge assets are tacit knowledge. And Conceptual and systemic knowledge asset are explicit ones. Experimental knowledge assets are employees' skills, ability, and expertise. Routine knowledge assets are employees' understanding about organization's routine work, structure, and culture.

Four Categories of knowledge assets
(Nonaka and Takeuchi)

Experimental knowledge assets Tacit knowledge through common experiences Skills and know-how of individuals Care, love and trust Energy, passion and tension	Conceptual knowledge assets Explicit knowledge articulated through images, symbols and language Product concept Design Brand equity
Routine knowledge assets Tacit knowledge routinized and embedded in actions and practices Know-how in daily operations Organizational routines Organizational culture	Systemic knowledge assets Systemized and packaged explicit knowledge Documents, specifications, manuals Database Patents and licenses

Figure 3.8 Knowledge assets. Image originally published in 2007, <<SECI model>> by Tom De Geytere, available at http://www.12manage.com/methods_nonaka_seci.html

SECI model is highly challenged. Critics argue the distinction between tacit and explicit knowledge is oversimplified, and even that the notion of explicit knowledge is self-contradictory. Besides, some scholars claim the focus on management of explicit knowledge is simply a repackaged form of information management.

However, SECI model gains greatly value and contribution in Knowledge Management domain. It verifies knowledge can be managed, directly or indirectly, by management of explicit knowledge and transfer process. Further, it identifies the sources of knowledge and basic activities of knowledge management. It argues the importance of social perspective in knowledge management. The term ‘Explicitly Knowledge’ can be considered as activator, a medium for catalysis, which directly or indirectly causes knowledge acquisition.

3.2 Explicit Knowledge Management

Explicit knowledge is crystallized knowledge nugget. Comparing with tacit knowledge, explicit knowledge is firm and static. Explicit knowledge can combine multi-aspects tacit knowledge, make it more cohesive and coherent. Due to its accessibility, explicit knowledge can be considered as collective knowledge.

3.2.1 Knowledge representation

During the knowledge transfers, how to represent knowledge is an important question. How to represent “unspeakable” tacit knowledge into a sense-making format which helps learning?

As Turban & Aronson (2003) state, “a variety of knowledge representation schemas have been developed over the years. They share two common characteristics. First, they can be programmed with computer languages. Second, they are able to be reasoning.” Some scholars advocate that those representation schemas are the best way to represent organizational knowledge. Because those representation schemas work perfectly with lots artificial intelligence techniques: expert system, decision support system, and inference techniques.

Unfortunately, due to complex nature of knowledge (see section 3.1.1), it is difficult even impossible to represent all the knowledge from an organization into those programmable and reasonable schemas, like relational algebra or decision tree. Every organization has countless documents written in or entangled with human language. Transformation between human language and representation schemas is costly and difficult. Further, common knowledge workers are not familiar with those representation schemas. They can’t work with those representation schemas in their routine.

It seems that the feasible representation of explicit knowledge is in human langue. Surely, human language has its own limitation; it requires

understanding of context, it is ambiguous and redundant. The human langue representation may not cause knowledge acquisition or learning. This is one of main challenges of current knowledge management.

However, information technology improves human langue-based knowledge representation. Today, information is not simply in text; it also includes documents, graphics, pod-cast, videos, photos, hyperlinks, programming codes, applications and etc. Data visualization technologies make information more scenario-based and sense-making. The author will use the term content to narrate explicit knowledge.

3.2.2 The importance of knowledge externalization and combination

Most organizations have some “knowledge externalization” institutions, like project reports. Usually, knowledge workers are not like take those institutions, they think those work are troublesome and lack of creative. And organization usually doesn’t value those documents, the outcomes of the knowledge externalization.

Fischer & Ostwald (2001) argue, “workers are reflective practitioners, who struggle to understand and solve ill-defined problems. Workers create knowledge at use time.”

However lots tacit knowledge will be lost or not traceable, especially in organizational level;

Roberta Vanetti (2002) states

> “Mr. Dave Whitewam, the president of Whirlpool, dread to watch the staff of his company while they wasted most of their precious and costly time re-starting activities and project from scratch, when the same work had probably already been dealt with by other.”

The knowledge externalization institutions give knowledge workers opportunities for reflect and record their work and knowledge. Externalization can immortalize the ephemeral tacit knowledge. and externalization makes knowledge accessible for others.

Brown and Duguid (1995) note:

> “The idea of a document is an example of what Michael Reddy calls a “conduit” metaphor. People regularly describe most communication technologies in conduit terms, talking if information as “in” books, files, or databases as if it could just as easily be “out” of them. We ask or asked to

put ideas “down on paper,” to “send them along,” and so forth. ”

Knowledge workers eventually will benefit from the knowledge externalization institutions, they could avoid the mistake of other or past. Further knowledge externalization also can alleviate information overload

The knowledge combination institutions are also crucial; they revise, update and integrate those externalized knowledge content. Those institutions make knowledge more coherent.

3.2.3 Ontology-based Knowledge Repository

Next question is how to management those documents as explicit knowledge. There is another important concept needed to be introduced: knowledge repository. As a key component of knowledge management system, knowledge repository stores the explicit codified knowledge from internal and external sources. There are many approaches to build a knowledge repository; one of them is ontology-based.

In computer science and information system domain, ontology is the common model that represents concepts and the relations between them. The fundamental elements in ontology are classes, attributes (also call as property), relations, and instances. For an example, there is a small ontology-based knowledge representation about a specific company’s products (see figure 3.9). There are 6 concepts, or call objects, in Figure 3.9. The concept ‘product’ refers all the products for this organization. There are two subclass concepts come from ‘Products’: ‘Automobile’ and ‘Home appliance’. The concepts ‘Motorcycle’ and ‘Truck’ are subclasses developed from ‘Automobile’. There are two instances products under the concept “Dryer”. This model can considered as the framework of a small knowledge repository.

How to use this framework store and manage knowledge content? This ontology is meta-knowledge or call metadata, the “data about data,” of knowledge content. Each attribute is a container for specific explicit knowledge. In Figure 3.9, “marketing feedback”, “Develop cycle”, and “Design tips” are 3 topics of content. Knowledge workers can put the related knowledge content into those 3 ‘folders’.

This ontology-based knowledge repository ensures that users can locate the content they need; meta-knowledge describes the semantic relation among the knowledge. People always complain that current information search/ retrieve system, base on key word, has a very poor performance. David Southgate (2005) states that: “creating the right search string on the company intranet can become like finding the proverbial needle in the haystack.”

And full-text searching doesn’t address retrieval of non-text objects such as images or video. But, by the ontology, knowledge workers can search the knowledge base on context. The types of knowledge content are varied; they can be numeric and logic value, or documents, video, audio, and graphic, Worksheet, MS PowerPoint and WebPages.

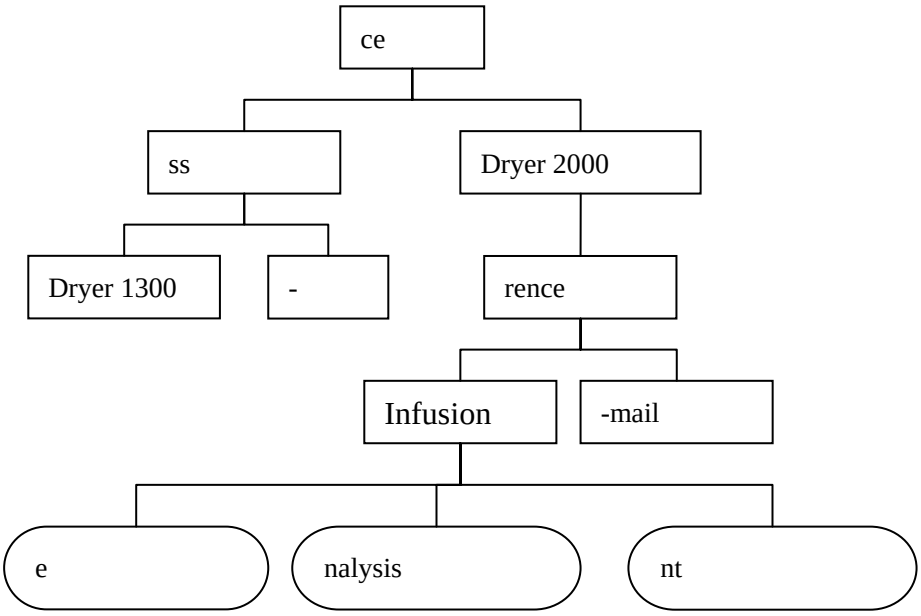

Figure3.9 ontology-based knowledge representation

Obviously, a single ontology hardly describes the entire knowledge of an organization. Therefore a useful knowledge repository should integrate multi-ontologies.

3.3 Social Computing

J.C. Thomas (2001) argues that “knowledge work is not a solitary occupation, but it involves communication among loosely structured networks and communities of people.’ Therefore, a successful knowledge management must include the managements on those communications, communities, and networks.

3.3.1 Communications as Knowledge transfers

Communication and conversation are main sources of learning, simply making information a may not cause knowledge acquisition. In the learning process, conversation with tutors or study mates is very helpful.
J.C. Thomas (2001) states

> "Conversation is a deeply interactive intellectual process. As the conversation proceeds, people are continuously attempting to interpret what is said, verify that they have been understood, and offer new contributions. Sometimes misunderstandings occur, and so people attempt to fix them by rephrasing our words, or "debugging" the previous conversations. What all this amounts to is that conversation is a superb method for eliciting, unpacking, articulating, applying, and re-contextualizing knowledge. "

One of knowledge management's goals is to encourage staff have this kind of conversation in their work. People call it "knowledge sharing" or "information sharing". However, knowledge sharing isn't simply happen as it wished. Because knowledge is part of wealth and power, sharing it requires social capitals, a business and sociology concept. Social capital is the connection between individuals and entities that can be economically valuable. It includes connections, relationships, common context, and trust. So a successful knowledge management needs rich social capital. (In the following section 3.3.4, it will mention how to develop social capital)

All the communications within an organization can be put into 2 categories: informal and formal communication.
Bill English, from Microsoft, describes

> "Informal communication, which is also known as collaboration, occurs when information is shared spontaneously between individuals who work for or are associated with a corporation." Informal communications can take in many forms and places: oral, e-mail and instant message; hallways, meeting room, and over lunch. As workers pursue a formal goal, they need to be able to share information, feel they are "being heard".

Formal Communication is usually referred to as publication workflow and organizational documents, like financial report, white paper, projects specification, or marketing brochure. Formal communication Information is more crystallized and official. Formal communication deals with explicit knowledge.

Both formal and informal communications carry knowledge transfer. Employees are learning, teaching, and sharing in those processes. IT has been greatly impacted on communications.

Digital communication can be synchronous and asynchronous, local or remote. And the communication can be preserved, searched, browsed, annotated, and reused.

3.3.2 Social Network Analysis

As mentioned before, knowledge fluxes in a loose structured social network. Knowledge management needs to analyze this social network. Here, the author introduces one technique to do this task: Social Network Analysis (SNA).

Social Network Analysis is a study of social relations among a set of actors by applying network theory. It represents the social structure in network, like the concept “graph” in discrete mathematics. (See Figure 3.10) A node represents a member, or call actor; the edges which connect the nodes represent the relation. This diagram simply and suggestive illustrates the relation between actors.

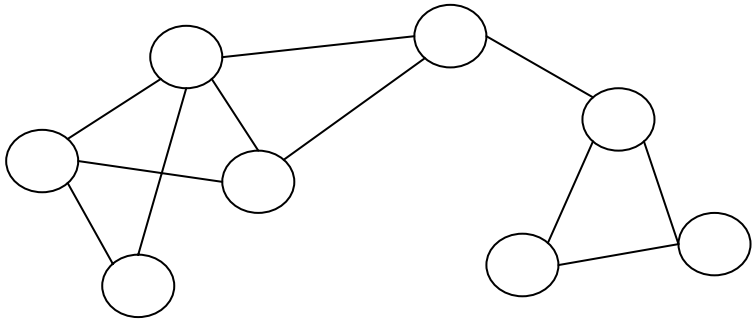

Figure 3.10 a social network diagram

There are formal and Informal structures inside the organization, the formal is hierarchical structure. Informal structures are how employees communicate, their group, faction. SNA can be used in study the informal one.

For one instance, Rob Cross and his colleagues, from IBM, studied a petroleum company’s exploration and production division structure (see Figure 3.11). Under this exploration and production division, there are three official sub-divisions: exploration, drilling and production (see left side of figure 3.11). Look the informal structure of this division (right side of figure 3.11), there are two main factions. On the upper of this network, O’Brlen, Stock, Shaplro and Paine are isolate from rest of employees. The four people belong to the same sub-division Production. This phenomenon shows that the Production group doesn’t communicate or collaborate with other much. Employee Cole is the centre of whole social network, rather than the vice president Jones.

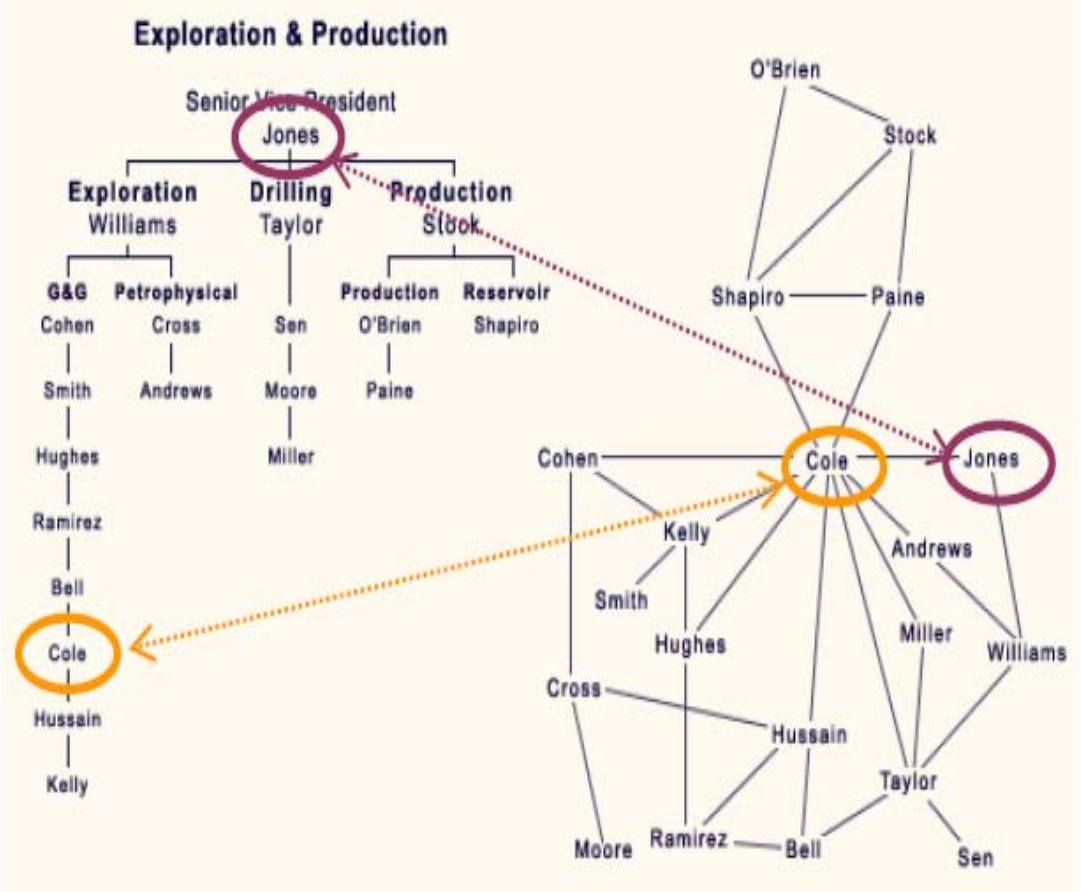

Figure3.11 Formal vs. informal structure in a petroleum company, the Image originally published in 2002 <<A bird's-eye view: Using social network analysis to improve knowledge creation and sharing>>, IBM Institute for Business Value, Available at http://www-935.ibm.com/services/au/igs/pdf/g510-1669-00-cpov-a-birds-eye-view.pdf)

Rob Cross and his colleagues sum several issues about SNA (see Figure 3.12):

Bottlenecks:	Central nodes that provide the only connections between different parts of the network.
Number of the links:	Insufficient or excessive links between departments that must coordinate effectively.
Average distance	Degrees of separation connecting all pairs of nodes in the group.
Isolation	People that are not integrated well into a group and therefore, represent both untapped skills and a high likelihood of turnover.
Organizational subgroup (cliques, faction)	It can develop their own subcultures and negative attitudes toward other groups.

Figure 3.12 SNA phenomenon

Knowledge Management aims to reform this social network, reduces the bottlenecks, isolations, and cliques.

3.3.3 Shift to knowledge network analysis

Social network analysis simply shows social connections within a organization. If the some attributes can be plugged into the social network analysis diagram, the knowledge network can be simply illustrated.

The attributes are to describe both nodes and edges. The attributes about nodes can be what knowledge individual hold, or what kind of learner or teacher he or she is: such like passive or active, expressive, or his or her learning curve.

The attributes about edges can be what kind of communication channel between the nodes, like face-to-face or online. Figure 3.13 is a example for Knowledge Network analysis.

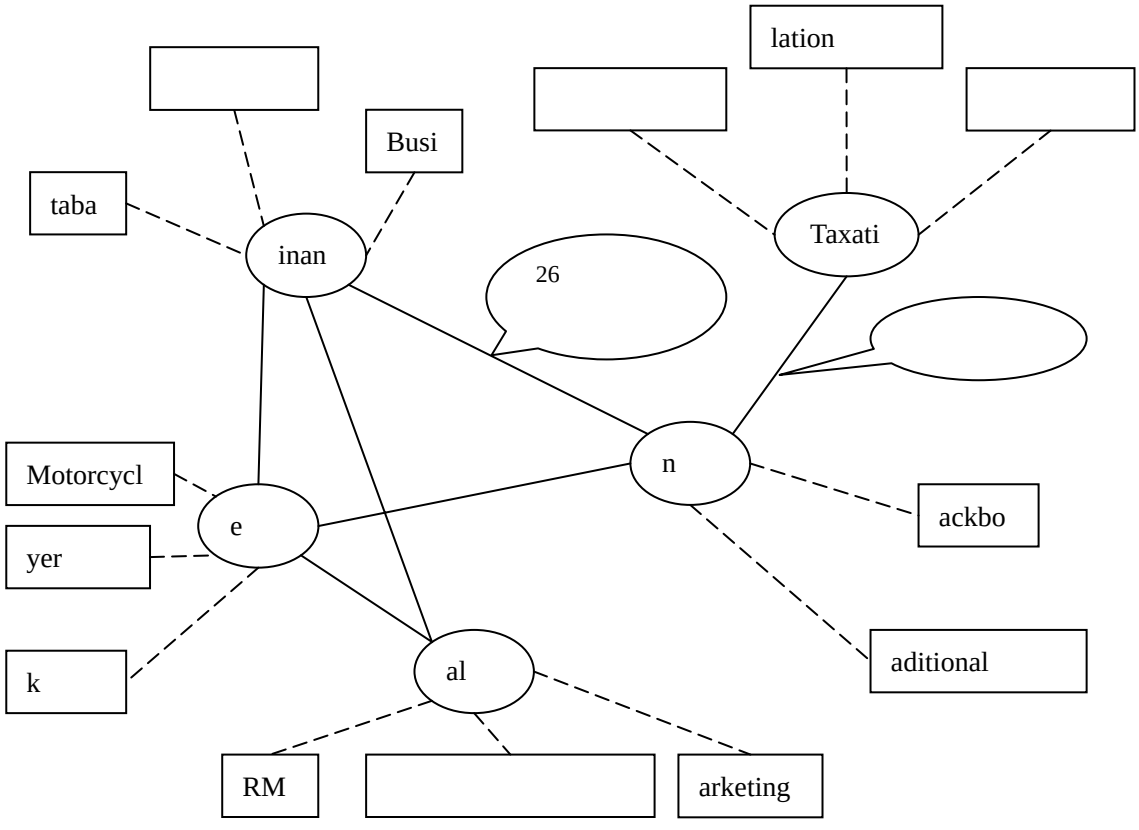

Figure 3.13 an instance for knowledge network

In reality, the situation is more complex than this diagram. Some edges are stronger or weaker than other. There maybe more than one person holds the same type of knowledge, but someone knows this knowledge better others.

In the section 3.2.3, the concept meta-knowledge is related with knowledge network. Meta-knowledge provides a framework of all the knowledge organization hold, and knowledge network identifies the tacit knowledge locations and connectives. It can develop the Experts directory, as the same as the old slogan: who knows whom, and who knows what. Knowledge network and knowledge repository also can show what types of knowledge the organization lack of, and who should in charge to learn the new knowledge.

3.3.4 Community of Practice

In reality, there are always groups of people regularly sharing and leaning, based on common interests and habits, like Golf Club, Salon. The theoretical title for those groups is community of practice (CoP).

E.L.Lesser, from IBM, (2001) states:

> "Community is engine for the development of social capital. Social capital resident in communities of practice leads to behavioral changes, which in turn positively influence business performance"

John Ward & Joe Peppard (2005) argues:

> "Many researches show that people most freely share experience in informal, self-organizing network, like community. Consequently, it becomes necessary for organizations to create and promote those environments"

J.C. Thomas (2001) claims:

> "An infrastructure for Knowledge community, social translucence, supports long-running, contextual interactions (as opposed to short-term, task-focused activities). It very deliberately blends work and social work, private and public discourse. The aim is to provide a digital substrate upon which knowledge communities can grow, and where "discourse base", rather than databases, can provide a medium for people to develop, share, and reuse experiences and knowledge, and watch other do the same. "

Within organization, community can be the members using the same techniques and software, equipments. For examples: Windows Vista users' community, or SAP, Java Bean users' community. Members of those communities not only lever each other's knowledge, but also build social capital. It means that communities are shaping social network, they can reduce the bottlenecks, isolations, and cliques.

Information technology re-labels those communities into e-community. There are many famous e-communities: Myspace, youtube, Wikipedia, and etc… E-communities have all the advantages of e-communications: remote and asynchronous access, multimedia, and reserved record.

Knowledge management should create and promote internal communities. Those communities are very important sources of knowledge. And knowledge management system should absorb knowledge from those communities into explicit knowledge.

3.3.5 Workflow management and Committee of Experts

Today, business activity becomes more and more complex. It requires numerous aspects of knowledge, expertise, and specialists. Legal, financial, technical, marketing, management expertise need to work together. And the collaboration is also getting more and more complex.

John Ward & Joe Peppard (2005) describe

> "This cooperation will not be the straightforward sequential application of one expertise after another, but is more likely to be the iterative exploitation of these expertises, since a change in one expert's input could have consequences elsewhere. In a gathering of such experts, each will bring their functional competency to bear on the project. However, to make a successful business activity will need more than the sum of the parts-what is needed is the managerial know-how necessary to integrate these into a successful process."

Organization needs make its knowledge be more coherent, comprehensive, and integrated. The knowledge should be able support complex business activities.

Workflow management can help collaborative work more clear and transparency. David Hollingsworth, from the workflow Management Coalition, a non-profit, international organization of workflow vendors, users, and analysts, (1995) defines

> "Workflow is concerned with the automation of procedures where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to an, overall business goal."

> "Workflow management system is a system completely defines, manages and executes "workflows" thought the execution of software whose order of execution is driven by a computer representation of workflow logic"

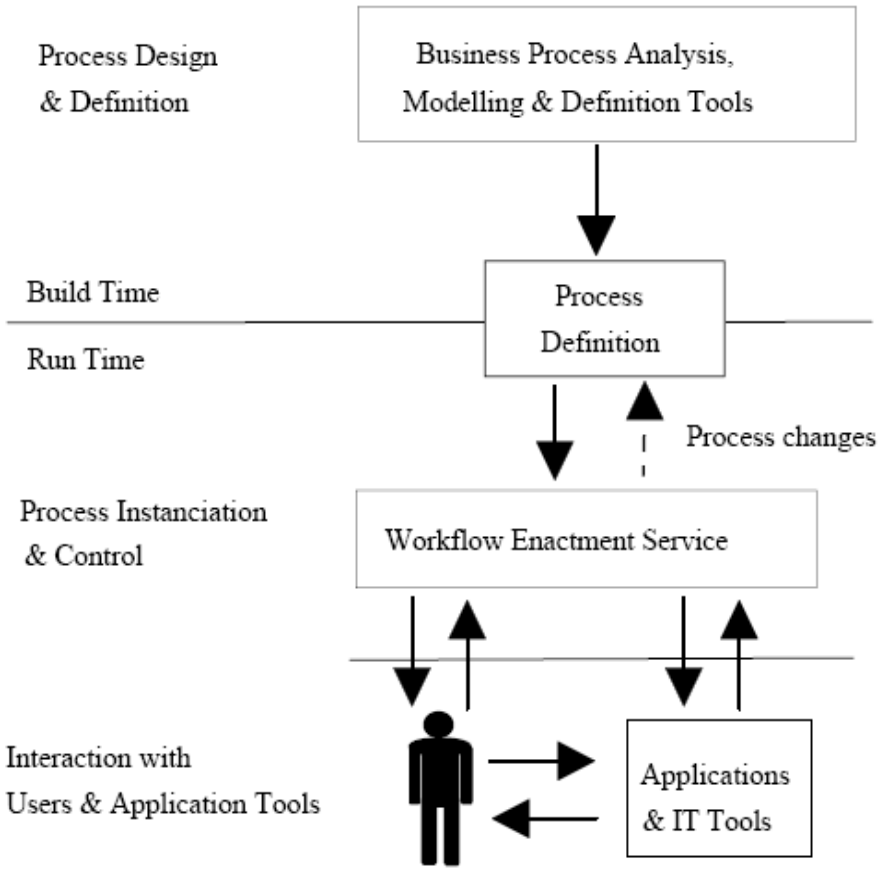

Figure 3.14 workflow management systems, the Image originally published in 1995 <<Workflow Management Coalition: the workflow reference model >>,by David Hollingsworth, from Workflow Management Coalition

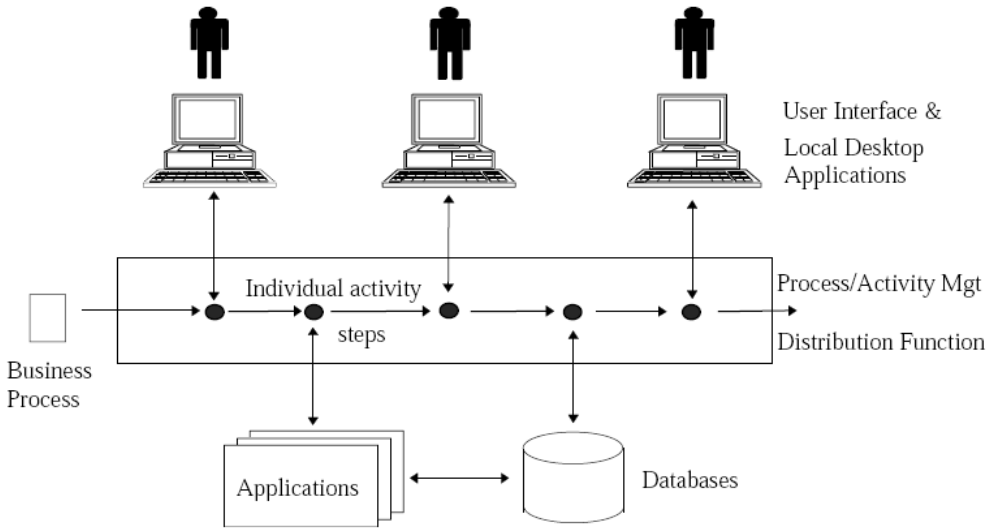

Figure 3.15 workflow management supported collaborations, the Image originally published in 1995 <<Workflow Management Coalition: the workflow reference model >>, by David Hollingsworth, from Workflow Management Coalition

Workflow is manual and standard for collaborations. (See Figure3.14 and 3.15)

A knowledge committee is group of experts relates the business process, they discuss about the business process, and modeling it into workflow. And then the experts locate human and other resource on the business process. They also should monitor workflow in run time. These workflow creation and management tasks are deal with knowledge heavily. They need to quickly response those tasks, interactive communicate with other, and modify the workflow documents, if necessary. The expert committee should have a platform of this knowledge integration and combination. It is like a “discussion table”, experts from different parts review the business from their own aspects, and try to creating a knowledge dashboard.

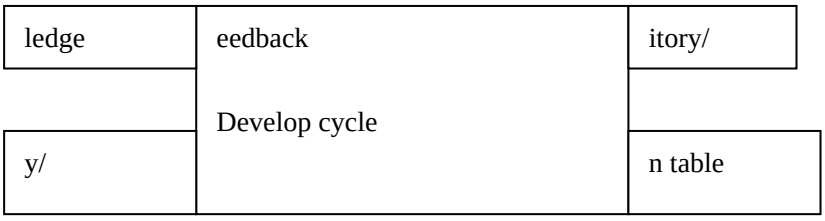

Figure 3.16 a simple model for a knowledge committee.

The differences between community of practice and expert committee:
Community of practice bases on interests, expert committee bases business task. Knowledge and communication in community is more informal, and knowledge and communication in expert committee is more formal. Community aims the same aspect of knowledge, and expert committee aims multi-aspects of knowledge.

3.4 Definition and content of Knowledge Management

After see each piece of puzzle, now it is time put them together, reveal the essential of knowledge management.

3.4.1 Definition of Knowledge Management

Despite of inconsistent definitions of knowledge management, most schools define Knowledge Management as a processes cycle to identify, transfer, store and disseminate the knowledge in order to reuse, awareness, share and learn it across the organization.(Efraim Turban et al., 2001; Davenport et al.,1998)

(see Figure 3.17 and 3.18).

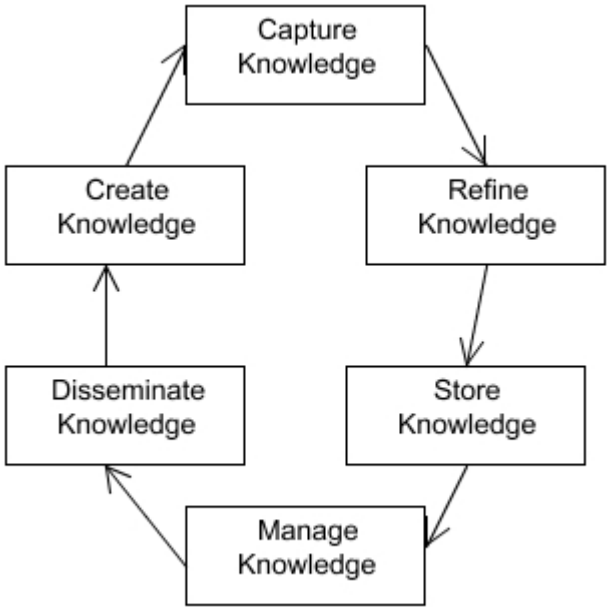

Figure 3.17 Turban and Aronson's Knowledge Management cycle, image originally published in 2001, <<Decision Support Systems and Intelligent Systems>> by Efraim Turban & Jay E. Aronson

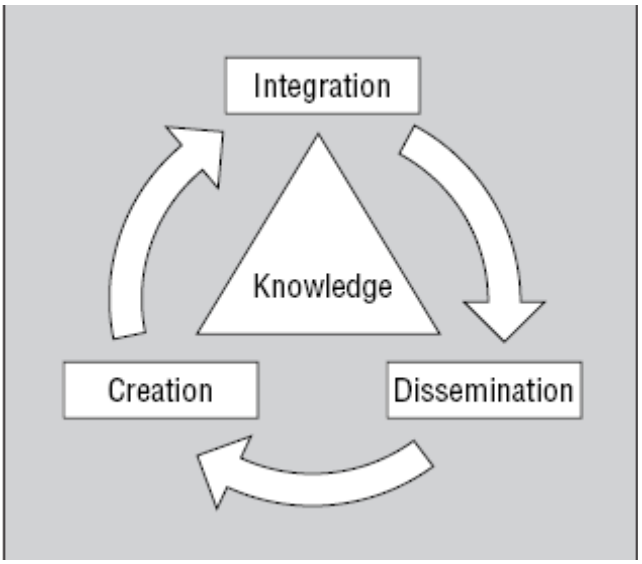

Figure3.18 Fischer & Ostwald's KM model, image originally published in 2001, <<Knowledge Management: Problems, Promises, Realities, and Challenges >> by Fischer. Gerhard & Ostwald, Jonathan, University of Colorado (2001).

J.C. Thomas and his colleagues, from IBM, (2001) argue that this kind of definitions pay little attention on social aspects in Knowledge Management. "Knowledge is inextricably entwined with the social milieu." As mentioned above, knowledge is fluid within a loose structured social network. The Knowledge management processes, such as identifying, transferring and disseminating knowledge, heavily entangle social factors. Therefore, a sound

holistic knowledge management should cover both process aspect and social issues.

In the knowledge creation process, creators are knowledge worker; they create knowledge during their work and reflection. They create both tacit and explicit knowledge. Usually tacit knowledge is richer than explicit, but tacit knowledge is more likely loss or untraceable. Therefore, externalization and knowledge repository is wise choice, externalization solidifies tacit knowledge, and knowledge repository centralized mange explicit knowledge. Knowledge integration is convenient in such centralized knowledge repository. In the dissemination process, knowledge worker gains knowledge form tacit and explicit source. Tacit source is more interactive, but requires social capital.

3.4.2 Knowledge Management and knowledge transfers

Knowledge management is about knowledge transfers, between explicit and tacit, between individual and collective. Transfers are not sole lever the amount of knowledge, but also make knowledge more coherent, more valuable. Knowledge transfers are on-going processes, both individual and organization are benefit from the accumulation and transfer.

Beside, knowledge transfer has other effects, knowledge transfer shapes the social network, improve organizational environment. Knowledge transfer also makes staff more expressive and innovative.

3.5 The business initiatives of Knowledge Management

There are mainly 3 perspectives of knowledge management initiatives: Adaptation on employees changing, Improvement of products and services, and optimization about organizational performance.

3.5.1 Adaptation on employees changing

Retirement and resignation frequently happen in any organizations. Human resources are becoming more and more dynamic. Employees leave the organization with their tacit knowledge. When new employees join the organization, some trainings or adjustments are probably necessary. Employees can quickly find the clues. How to minimize the loss of retirement and resignation? How to seamless adapt the new employees and reduce training cost? Knowledge management could be the solution.

3.5.2 Improvement of products and services

Products and services are the crystalloid of knowledge. When organization wants to improve their qualities or reduce their costs, Knowledge is surly needed. Knowledge management programs can that knowledge available.
One of the most common business initiatives of Knowledge Management is achieving shorter new product development cycles.

3.5.3 Optimization about organizational performance

Knowledge management boosts organization moving to knowledge-based and learning organization.

Knowledge management motivates employees be more creative, innovative and willing to share knowledge.

Knowledge management also builds social capital, changes organizational culture. It improves organizational communication and coloration. Knowledge management tries to prevent repeating the errors of the past

Chapter 4: Business Strategic planning on Knowledge Management

A business strategic planning for Knowledge management is vital. Planning outlines the relation among knowledge management system, enterprise, and its business strategy. Business planning can gain the support of management level.

4.1 Identify the demand and feasibility of Knowledge Management

It is impossible that knowledge management is appropriate for every organization, especially SME. Therefore identify the demand and feasibility of knowledge management.

Questionnaires:

Does your team have sufficient knowledge to handle task?
Does your team have AAR(after action review) ? do you think it important
Does your team need to collaborate with other lot? Can you find right person to contact with?
How you think project document or report is important?
Do think your team learns from its experience?
Can you track your work easily?
In everyday work, can you find the needed information right way?

How do you think your information retrieve system?
Do you still need to learn new skill for your work?

Figure4.1 a sample for knowledge management questionnaire

Knowledge management project can help the problems like: employees training, project management, and team communication and performance. Interview and survey the front line employees. In generally speaking, there are several factors which determine the demand for knowledge management. (See Figure 4.2)

The type of industry
The number of knowledge workers
The type of knowledge workers
The geographical complexity of organization
The departmental complexity of organization

Figure 4.2 the list of factors which determine the demand for knowledge management.

The type of industry of the organization is an influencing factor. Some industries are so-call “knowledge economy” or “knowledge-intensive industry”, they are sensitive about knowledge. (See Figure 4.3) Those industries share many commons: project-oriented, consultancy service. For the enterprises in those industries, knowledge management is more likely to be invested.

Hardware and software consultancy and supply
Research and experimental development on nature/social science and engineering
Legal activities
Business and management consultancy activities
Architecture and Construction activities

Figure 4.3 an incomplete list of knowledge-intense industry

The number and type of knowledge workers also determine the demand. Geographical and departmental complexity of organization is big motivation for knowledge management. A geographical complex company has many groups of people working on the same business but at different regions. Those people need channel to share their knowledge, expertise, and experience.

Besides identifying the demand, a feasibility analysis should be taken. The feasibilities include finance, technological and social aspects.
Technology feasibility is about whether organization has sufficient IT resource to support knowledge management. IT architectures and IT staff are the main parts of IT resource. IT staff are needed to deploy, maintain, and administrate

the system. New knowledge management applications need to build on existed IT architecture. Finance feasibility is about budgets, software outsourcing, and purchase license. System customization, tanning cost, maintain system.

Knowledge management program needs large investment, especially at launching phase. As mentioned before, SMEs usually don't have IT or finance leadership. Launch knowledge management program is vital decision.

Social aspect shouldn't be overlooked. Organizational culture predicate user reaction to the knowledge management system, can the users use the system in the ways they supposed to?

Sullivan's 2x2 matrix model can analyze the organization's internal IS environment.
He describes two axes within which an organization can consider the implication of these forces, Infusion and Diffusion:

Infusion: the degree to which an organization becomes dependent on IT/IS to carry out its core operations and manage the business;

Diffusion: the degree to which IT has become dispersed throughout the organization and decisions concerning its use are devolved.

Traditional: highly-centralized control of IT resources and Information System is not critical to business.
Backbone: highly-centralized control of IT resources and Information System is critical to business.
Opportunistic: not overall business or IT designs.
Complex: IT is critical to business, and there is no strong centralized control of IT resources

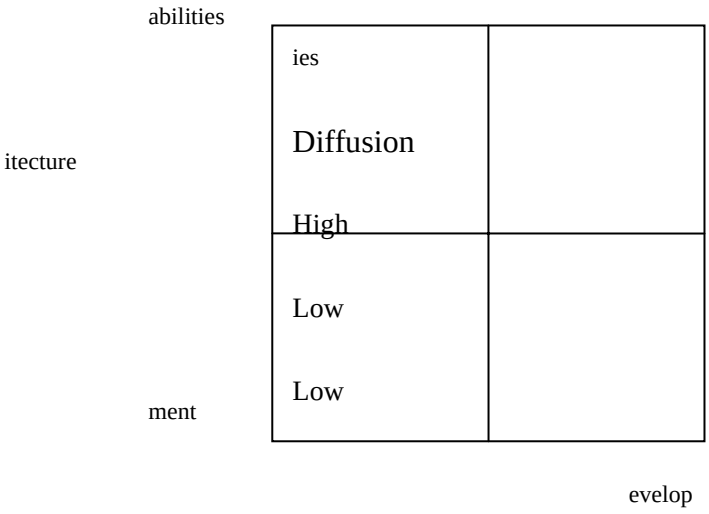

Figure4.4 The internal content of IS environment

The author believes that diffusion can show the demand of knowledge management, and infusion can show the feasible of knowledge management. So, a “complex” type organization is the ideal for knowledge management, but SME usually doesn’t have a complex IS environment.

However, SME has its advantages for taking knowledge management. Social network of SME usually is less complex, so the network is easy to analyze and modify. SME’s organizational culture is more flexible and changeable than large organization.

4.2 Develop knowledge management strategy

Knowledge management strategy should be part of IS/IT development strategy.

Knowledge management strategy sounds bureaucratic, but knowledge management program is a long time, and costly program. This strategy level planning can keep it on this right track. The implementation must be taken step by step, limit change on technique and business.

This Knowledge management strategy must be aligned with company’s business strategy. Michael H. Zack claims (1998) ‘An organization strategic context helps to identify knowledge management initiatives that support its purpose and mission, strengthen its competitive position, and create shareholder value.’

There are several issues which must be included in Knowledge management strategy: the scope of program, requirement, and objectives, and Cost and benefit Analysis document

4.2.1 Find requirement and design sub-projects

Finding requirement task seems overlapping with identifying demand. The different is finding requirement is much more specified. Identifying the demand is to grasp the big picture.

Interviews managers from each key business unit, find their requirement for collaborative work, knowledge repository, Expert dictionary, and E-community.

Each team has its own requirements, record the impact on business and tech.
It is better that organizing these requirements into projects. Some similar requirements from different teams or departments can be put into a project. Some requirements from a team or department are too many to put into a single project, so it is necessary divide them into different projects.

One mission of knowledge management is to improve social and knowledge network. To achieve this mission, knowledge network analysis (mentioned in section 3.3.2 and 3.3.3) should be taken place. The social network analysis should find the problems in current social network: the bottlenecks, isolations, and factions (see Figure 3.1.2). The knowledge network analysis should find out locations of experts and weakness of this network. The most common weaknesses are incomplete knowledge and insufficient knowledge holders.

The Project Proposal addresses the business process to be impacted by the project and specifies the business strategy or objectives supported by the project. A Cost Benefit Analysis document is also included to detail the costs, benefits, risks, and funding sources for the project.

4.2.2 Sub-Projects' priorities setting

Because of limited recourses, it is not reasonable to invest all the projects. An evaluation and priorities setting process should be taken. This priorities setting is to support and align enterprise's business strategy

First is an analysis of current environment, both business and technical.
Review of the strategic business plan, including the statement of mission,

goals, objectives, strategies, and priorities that set business direction. And then assess about the current technological environment, including evaluation of the primary hardware requirements, application software, and connectivity. By this analysis, the company's short and long-term goals related to knowledge management can be identified. This analysis also can show the company’s technology weaknesses and needs.

The Project Proposal and Cost Benefit Analysis (mentioned in section 4.2.1) provide information for evaluation and prioritization proposed projects, as well as provide a mechanism to monitor costs and benefits during project implementation. Help understand the business impact, prioritize projects, and recommend funding.

Chapter 5: The implementation for knowledge management projects

In this chapter, the author wills discuss how to implement knowledge projects. Beyond doubt, there are plenty of approaches to a knowledge management system. Here, the author only outlines a general solution. For most SMEs, letting programmers build some applications is not good choice. Software outsourcing is more rational decision. There already are some reliable and strong vendors offering some software which can boost knowledge management. Before talking about implementation, there are two groups of software which needed to be introduced: Enterprise content management (ECM), and Collaborative-supported software (groupware).

5.1 The two footstones

These two groups of software are not just designed for knowledge management, so the set of their functionalities is different

5.1.1 Enterprise Content Management

Electronic documents are getting complex during the development of Information Techniques. Now, documents include text, data, graphic, images, metadata, styles, sound, and video. Even more, the requirements for publishing “document” also become complex: translations into multiple languages, multiple revisions, and regional versions.

Although, technically speaking, database can manage all kinds of data. Because Database supports the data types like text, images, hyperlinks even XML. The performance dramatically drops when workload increase. The functionalities offered by the database are becoming more and more insufficient. Therefore, enterprise content management is designed to help organization for those purposes.

AIIM (short for Association for Information and Image Management) defined (2005-2006) ECM as ‘the technologies used to capture, manage, store, preserve, and deliver the content and documents related to organizational processes’. ECM integrates the structured, semi-structured, and unstructured information.

ECM tools and technologies provide solutions to help users with the four C’s of business: Continuity, Collaboration, regulatory Compliance, and reduce Costs.”

The services provided by ECM solutions include content repository, search capability, version control, and replication of content changes, integration, content rendering, security, process management, and content delivery.

The ECM has metadata management capability. As mentioned above, (see section 3.2.2) metadata management is very important to a knowledge repository.

The activities of ECM are similar to knowledge management activities. (See Figure 5.1) An ECM infrastructure can greatly support the KM program. Further, ECM provides the connections between the front-end and back end applications. It makes KM integrate into organization's IS, rather than an isolated application. KM system can catch and output information with the front-end applications, make itself update.

Figure 5.1 AIIM ECM model, image originally published in 2004, << Planning for an Enterprise Content Management System: An AIIM User Guide >> by Hodgson.

The functionalities of ECM is larger than KM, it makes the investment more desirable. ECM is growing market. There are lots of remarkable vendors: Microsoft, IBM, SAP, Documentum, Hummingbird and etc. Surely, the capabilities of each product are different, as well price.

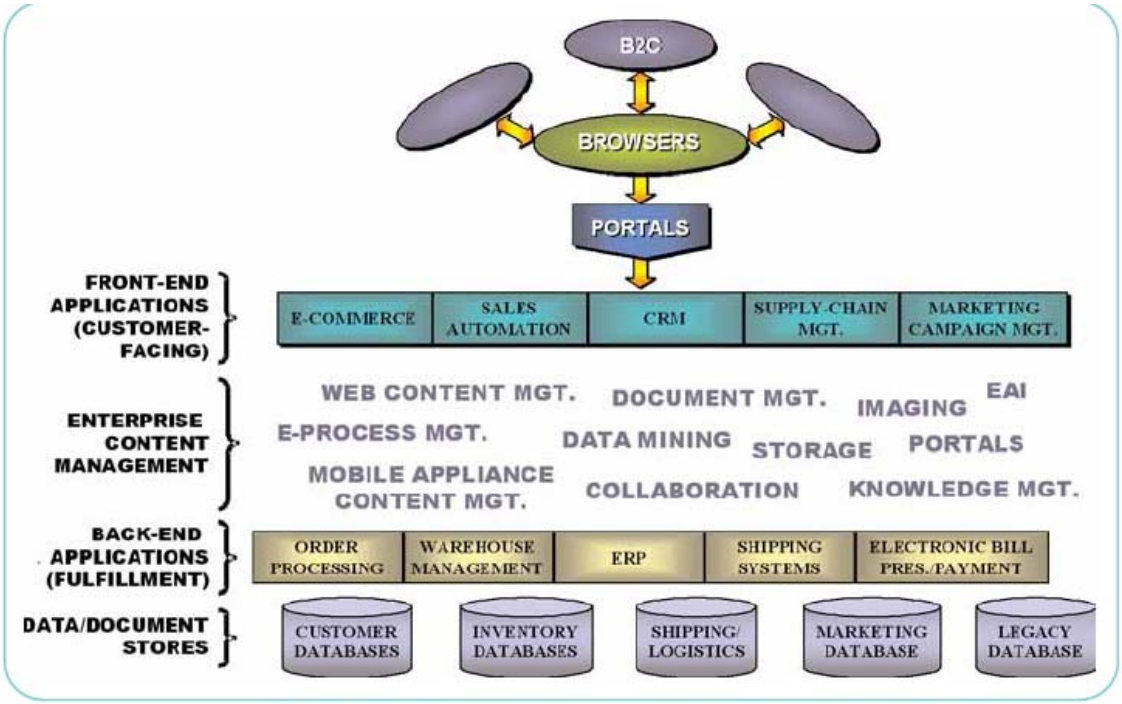

Figure 2: ECM provides the connection between back-end and front-end applications (Source: AIIM International)

Figure5.2 ECM provides connection between back-end and front-end applications, image originally published in 2004, << Planning for an Enterprise Content Management System : An AIIM User Guide >> by Hodgson.

Capture	Templates & Forms	Imaging & Recognition	Aggregation	Categorization & Indexing
Manage	Collaboration	Approvals & Digital Signatures	Workflow	Security & Access Controls
Store	Databases & Repositories	Search & Retrieval	Version Control	Check-in & Check-out
Preserve	Retention Schedules	Media Types	Offline Accessibility	Migration
Deliver	Component Assembly	Personalization & Notification	Reporting	Format Conversion

Figure 3: Critical ECM Component Capabilities

Figure 5.3 critical ECM component capabilities, image originally published in 2004, << Planning for an Enterprise Content Management System: An AIIM User Guide >> by Hodgson.

5.1.2 Collaborative software

Collaborative software, also known as groupware, has been applied since the mid of 1985. The Yankee Group, the first independent technology research and consulting firm, give a rigorous definition for collaborative support software, also known as groupware : “a complete groupware infrastructure has

three dimensions: **communication** (pushing or pulling information out into an organization), **collaboration** (shared information and building shared understanding), and **coordination** (delegation of task, sequential sign-offs, etc.,). ”

Collaborative software supports both synchronous and a synchronous communication.

There are two kinds of synchronous conferencing:

Text-base communication: MUDs - A MUD (Multiple User Dimension or Multiple User Dialogue) is a computer program which users can log into and explore. Each user takes control of a computerized character. The user can communicate with other characters. *Meeting rooms and meeting support software* - The main difference between this type of system and the other types of conferencing systems is the support for face-to-face meeting in specially designed meeting rooms with a large screen (e.g. video projector) and a number of workstations. Typical applications are brainstorming, voting, or rating.

Audio/Video Conferencing - In audio conferencing systems, participants in a discussion communicate using real-time voice communications. *Video Conferencing* - In video conferencing systems, two or more participants communicate using live video images. Video conferencing has the potential to improve communications over text or audio by allowing body language and facial expressions to be seen. Since these carry a large part of the information transmitted by speech, video conferencing is potentially much closer to face-to-face communication than any other medium.

Files and applications can transmission between participants.

There are also many types asynchronous communication: E-mail, Instant Messaging, Faxing, Voice mail, Wikis and Blog , and Internet forums, also known as discussion board

Wells (1996) argues some useful mechanisms of collaborations:

Multiple Views - Some systems allow users to establish personal views of the group conversation. For example, each user can create a personal view of items of particular interest on a certain topic. This topical view cuts across discussion threads, bringing together an outline of items in a single table of contents. The user now has a single view of the related items. Each of the users in the group will have their own view and the system will present all the views in the context of the group discussion. Thus each group member will have access to multiple views.

Public annotations - comments made to documents that visible to all subsequent readers anywhere on the Web, without modifying the original document.

Overlays - Overlays allow the annotations of different users to be differentiated in graphical interactions. Essentially, each user is allowed to draw on the electronic equivalent of a transparent foil. Such foils can be stacked. Overlays are also used to add different kinds of information to a picture, each on a different layer. This allows independently produced information to be combined easily.

Voting - These collaboration systems let participants vote on various things, and eventually see the results of the vote. Voting normally requires automatic tabulation to avoid subjective bias. An example of such a system is a movie guide where users input their votes for a particular movie and the guide displays the best or worst movie of the summer. These systems often take polls and display the results.

Audit Trails - The process by which a result was arrived at is often as important as the result itself. Audit trails provide a record of this process. Issues are how fine-grained the record is, and how non-repudiatable it is. Audit trails are usually part of the security mechanism, but are a groupware issue since the groupware, particularly in application sharing systems can obscure the source of an input.

Individuals interested in the document can post questions, complaints, corrections, and other action items in a centrally or issues log or task list. When the issues log contains a number of issues or issues of sufficient importance, the change control process can be invoked to pull the collaboration, and the workflow processes govern it s revision and release. ”

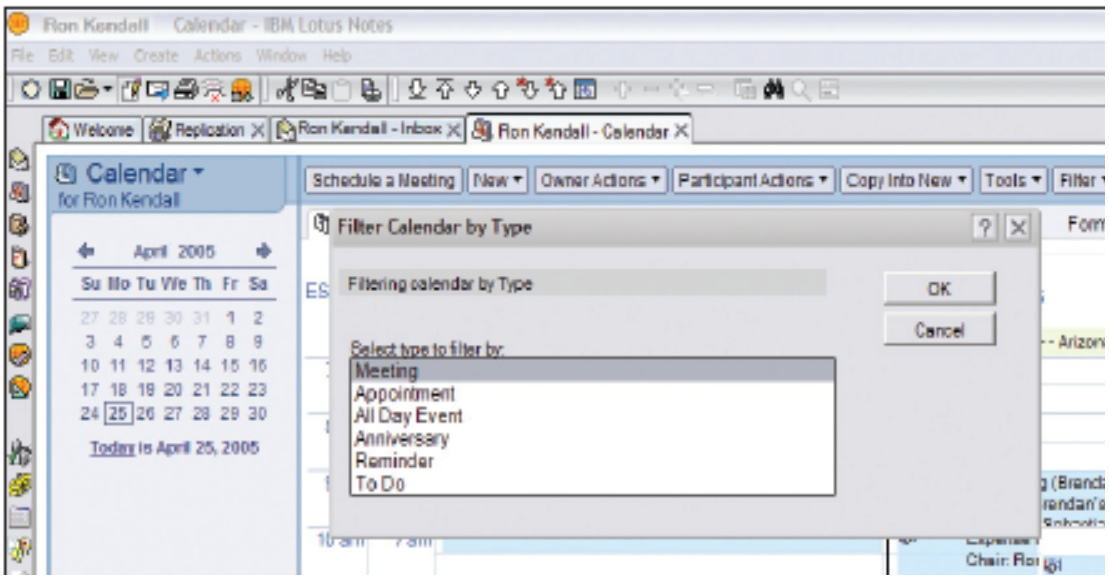

Figure 5.4 Filter Calendar IBM’s Lotus Note7, image originally published in 2006 <<IBM Lotus Notes 7>>, Lotus Software, IBM software group.

5.1.3 Relations among ECM, Collaborative support software, and workflow management

Enterprise content management overlaps and connects with collaborative support software.

5.2 Systemic deployment

5.2.1 Select vendor, and customization

There are many factors should be considered during the selection of vendors:
1. Functionalities
2. Performance:
   Here, performance refers the qualities about those functionalities, like: maintainability, extensibility, security.
3. Time required deployment
4. Integration capabilities: this factor becomes more and more important; can the new applications work well with the old ones?
5. Training requirements: The amount of training needed and availability of training courses and materials
6. Costs
7. Users' opinions

Most vendors have flexible customization services to satisfy the clients. Customization has different levels: user interface, functionality, integrated with legacy systems. Whether take a customization also is big decision. Customization is costly, both time and money.

5.2.2 Build knowledge repository
From technical aspect, ECM is the best candidate for knowledge repository. Its web content and document management capabilities can easily build a web-assess knowledge repository. ECM has the function for meta-knowledge, or call meta-data, management. Limitation access security

In practice, there are always three most questions which bother knowledge repository:
1. Who supposed to put knowledge into the repository?
2. What kind of knowledge supposed put into the repository?
3. Who supposed to use that knowledge?

Organization should have clear answers for those questions. It should institutionalize knowledge input processes, divide knowledge responsibility to employee. For example: AAR (after action review) is one of those institutions, the knowledge workers have to review their work after a project is done, and put the ideas on "papers". It sounds troublesome and mechanical; however, eventually it will benefit knowledge workers themselves and the

organization. This knowledge responsibility also empowers the knowledge worker, and motivates them be more expressive.
Evolution bottom-up develop this knowledge re

It is extremely important that avoid knowledge repository to be “dumping neither ground” nor “empty bag”, pay attentions on both quality and quantity. For instance, the following knowledge should be put into repository: Case study, Reflection, software or equipment specification, Meet record, and Best-practices.

5.2.3 E-communities

The best approach of e-communities is web-based. There are several forms of e-communities: Forum, Web-logs, Wiki, FAQs. In technical level, constructing those e-communities is an easy task, it only requires a web server, a database server and some web programming, even PHP+MySQL is totally sufficient for the job, and the cost is low. Beside, some collative platforms have the similar capacities, for an instance, IBM Louts note has blog capabilities. (See Figure 5.5)

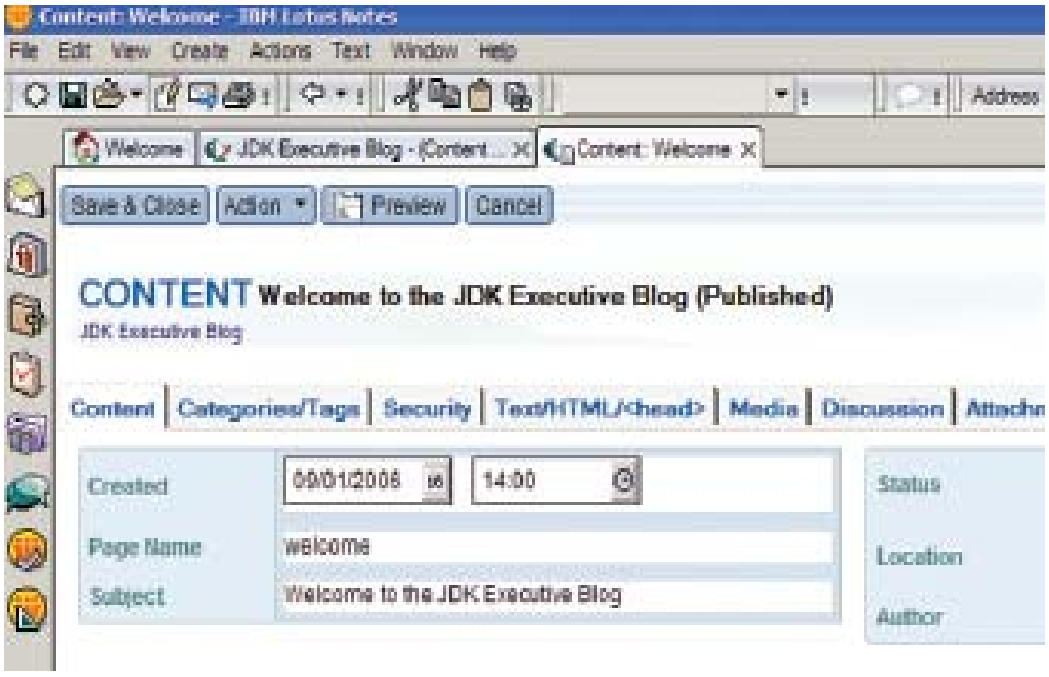

Figure 5.5 enterprise’s Web log in IBM’s Lotus Note7, image originally published in 2006 <<IBM Lotus Notes 7>>, Lotus Software, IBM software group.

Forum offers a place for informal discuss. Wiki and Web-log are the hot topics in today Internet world; they always can be applied into organization. Wiki, a web page allows everyone to edit it, can greatly motive employees to show their opinion, share their knowledge, and benefit from learning.
Web-log, also know as blog, the person or team page, can become employees’

personal knowledge portal.

The purposes for those acts are make employees more expressive, innovative and willing to share information. Further, those communities can build social capitals. Those communities are informal, and should be self-managed. ECM has web content management function to mange e-community WebPages.

Integrated knowledge search portals should cover e-communities web content and knowledge repository. Transfer crystallized knowledge from e-communities into knowledge repository.

5.2.4 E-committee of experts

A Collative platform is the best implementation tool for e-expert committee. Construct collative channels through all the experts. Experts can share workflow management applications. And ECM can manage workflow documents. Connect mail server, share folder, connect collative platform with other applications like ECM or workflow management software.

In Figure5.6, there is a brief summary of the three types of knowledge management.

Type of project	IT complexity	Purpose
Knowledge repository	Medium	Manage explicit knowledge
E-CoPs (Community of practice)	Low	Build social capital and leverage staff
E-committee	Medium	Improve task management

Figure 5.6 different types of knowledge management projects

5.2.5 IT architecture of knowledge management

EAI, enterprise applications integration, is a popular topic in those years. Although SME usually doesn’t great demand on applications integration, it is important to be aware of integration and messaging between applications. A well-structured IT architecture saves resource for maintain, and has a high performance and extensibility.

There are three common portals to access knowledge management applications: web portal, MS office plug-in and collaborative platform desktop. The MS office plug-in for directly publish or share documents. The three portals all need to connect with ECM and other IT components, one ideal

alternative is service bus, also known as Enterprise Service Bus (ESB). As Beth Gold-Bernstein (2004) states, “Service bus provides connectivity services, guaranteed message delivery, and data transformation.” Service Bus is design for Service Oriented Architecture (SOA). A IT architecture may seems like Figure5.6.

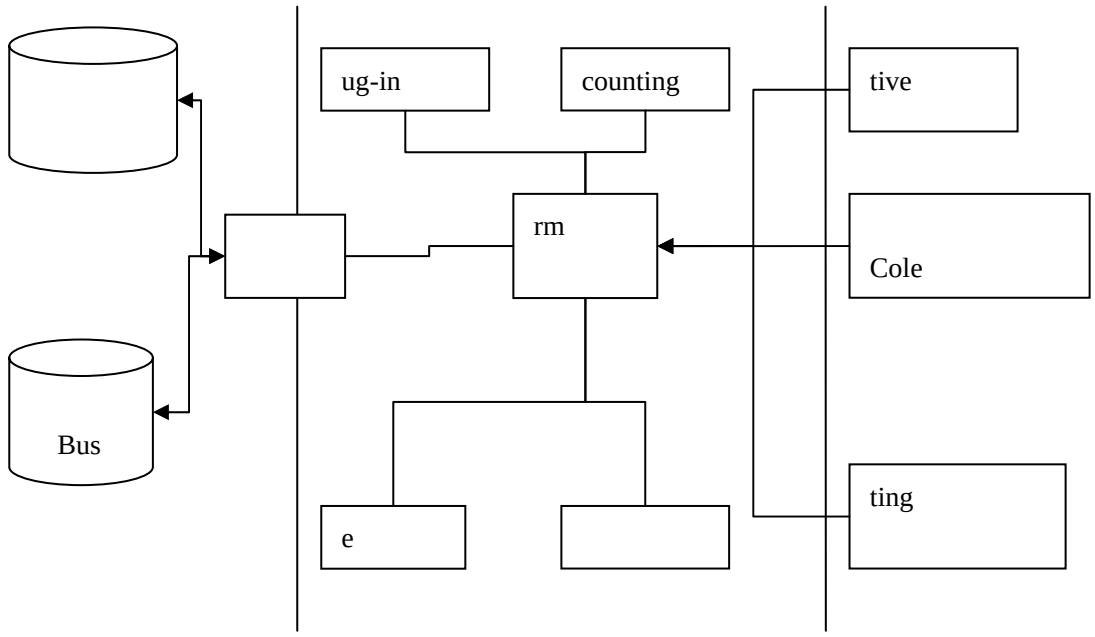

Figure 5.7 a possible IT architecture plug-in Knowledge Management

5.2.6 Monitor the knowledge management project

Monitoring is important in all kind of project; a timely monitoring can reduce risk of knowledge management project. There are three issues needed to be monitored: cost, benefit, and users’ attitude. As mentioned in 4.2.1, each sub-project should have two documents: Project Proposal and Cost Benefit Analysis. Track and review on those documents, check whether projects reach the objectives and the expense in reality.

As talked many times above, knowledge management is a social-technical task, rather than pure technical. Therefore social reaction is crucial and users’ attitude is a vital factor. Administrators and managers should check staff’s satisfaction about the system, whether they becoming more collaborative, effective or not. There is a phenomenon call drifting, system is used different from it supposed to. Beware of the drifting on knowledge management system.

Chapter 6 Empirical Work

The empirical work aims to apply the Knowledge Management roadmap into a real enterprise.

6.1 Background information of this enterprise

The author chooses a Bio-Pharmaceutical Company locates Hubei, China. Its name is Keyi Pharmaceutical Corp. According the 2005 Chinese Bio-Pharmaceutical industry statistic annual, this enterprise ranks No.385 in Chinese Bio-Pharmaceutical Industry. Rank by Sales Revenue of Independent Accounting Enterprises of Chemical Medicine.

The Keyi considers itself as a small and medium sized enterprise. It focuses on anti-virus medicine market, and has some competitive advantage in this segment of market; it has a medicine research center. Ganciclovir Sodium, an antiviral agent derived from guanine and used in the prevention and treatment of opportunistic cytomegalovirus infections, is the company's main product.

6.2 Business strategy:

The business strategy of this enterprise is to optimize all resource, develop research, manufacture, and marketing platforms, in order to develop the competitiveness on anti-virus medicine research.

There are several challenges of the enterprise. The performance of medicine research is not desirable. Their product is not diverse enough. They want new medicine products have a better life cycle and higher market sharing.

6.3 The demand and feasible analysis

Pharmaceutics is an ideal industry for applying Knowledge Management, since its nature is knowledge concentrated. Many their business processes are pure knowledge work.

The information about the enterprise's IT/IS environment is following:
The enterprise has a web server, and database server. The database system is Microsoft SQL server 2003. The firewall system is Microsoft Internet Security and Acceleration server 2004(ISA 2004). The enterprise also has a Cisco router, two ADSL line which backup each other, and decades of computers. The operation system of those computers is Microsoft windows XP. The main softwares running are Microsoft office and some pharmaceutics industry

software.

Because of the limited time, the social feasibility is not be analyzed.

6.4 “Medicine launching development committee” Project

6.4.1 Background of project

Among all the business processes of this enterprise, launching new medicine is the most complex and vital one. Medicines research is a long-term process; it usually takes ten year or even more for an experimental drug to travel from lab to a real product, and this process invokes different areas expertise. All these facts make launching new medicine a perfect target for knowledge management.

The general launching new medicine process is looks like following:
First is preclinical research and testing, a 3-4 years process, and then is clinic research and trial, 5-8 years process, finally step is new drug application. (See Figure 6.1)

	Preclinical Testing	Clinical Trials Phase I	Clinical Trials Phase II	Clinical Trials Phase III	Application
Years	3.5	1	2	3	2.5
Test Population	Laboratory and animal studies	20 to 80 Healthy volunteers	100 to 300 patient volunteers	1000 to 3000 patient volunteers	
Purpose	Assess safety and biological activity	Determine safety and dosage	Evaluate effectiveness, look for side effects	Verify effectiveness, monitor adverse reactions from long-term use	Review process / Approval
Success Rate	5,000 compounds evaluated	5 enter trials			1 approved

Figure 6.1 Phase of medicine development, image originally published in Alliance Pharmaceutical Corp. <<Phases of Product Development>>, by Dale E. Wierenga, Ph.D. and C. Robert Eaton, available at http://www.allp.com/drug_dev.htm

Putting this long-term and costly process in a real business environment, thing gets even more complex. The enterprise needs human resource management, instrument and equipment outsourcing, finance, and marketing researching.

The Keyi's launch medicine process invokes four departments and two committees: Informatics, Marketing, Compounds research, and Technology and manufacture departments; Science and technology committee, new medicine authentication committee. Informatics department offers the latest relative information to all other departments. During the research, marketing department contacts with hospitals and clinics for clinical trials. Technology and manufacture department studies how to reproduce the new medicine in an ideal cost, manage quality of products. Surly, the compound research department's task is scientific research on new medicine.

6.4.2 Objectives and blueprint of the project

The tasks of the "medicine launching development committee" are:

1. construct a collaborative platform
2. construct a workflow management system
3. construct a information search system
4. construct a project management system

The objectives are:

1. A high user's satisfaction
2. A low error rate
3. A shorter process
4. Low management cost
5. Improve new anti-virus medicine products' market sharing and product life cycle.

Blueprint of project

Construct a solid collaborative infrastructure (See Figure 6.2); it includes informal and formal communication channels, a knowledge repository.

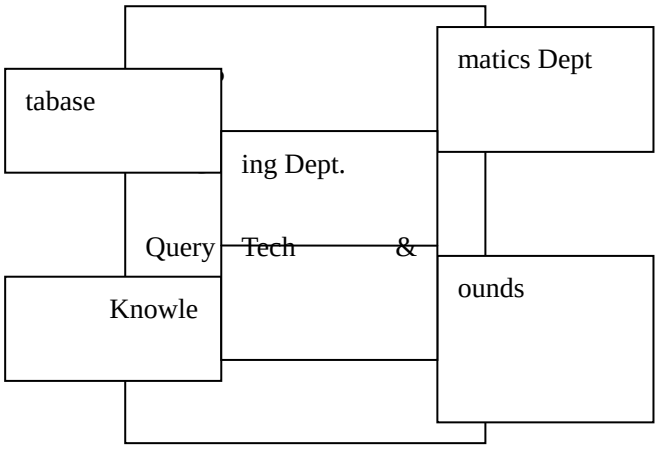

Figure6.2 collaborative infrastructure

6.4.3 Reconstruct communication channels

It is necessary to classify informal and formal communication channels. Formal communication channel is for official requests, reports, and etc…, it should be more “organized” and “clear”. Email, shared folders are not ideal formal channels. The formal communication channel should be an exclusive workflow platform; each workflow document should be written in a unified format. For instance, it should include sender, receiver, project name, technique invoked, and time. Those tags can support context-based search/ retrieve. At the time, workflow documents are published in enterprise content.

For informal communication channel, chat rooms and discuss tables are created for each medicine development project.(see figure)

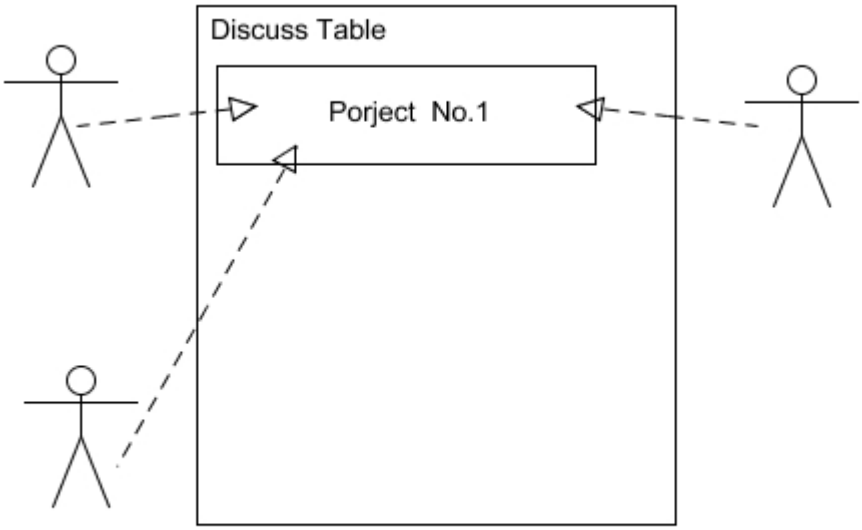

Figure 6.3 Discuss table

6.4.4 Develop a knowledge repository

In order to generate short-term outcome, this knowledge repository is both task-oriented and pattern-oriented.

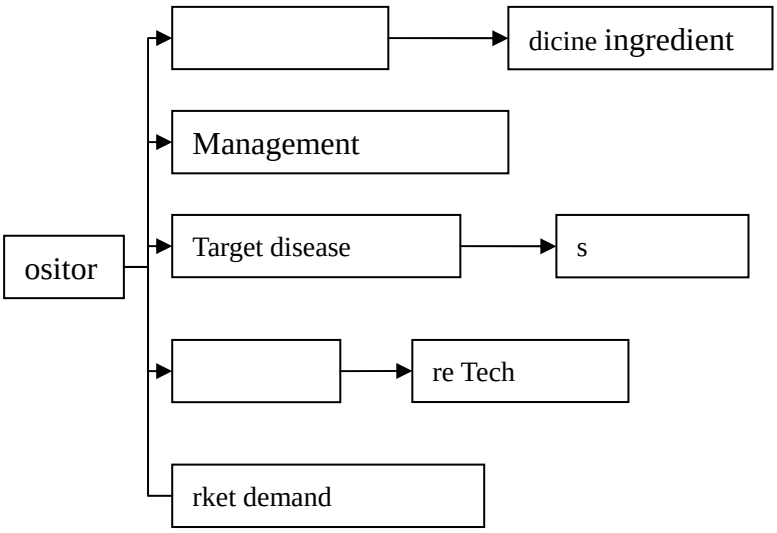

Figure6.4 Knowledge repository

In task-oriented level, this knowledge repository (See Figure 6.3) is a knowledge dashboard of each medicine research project. This knowledge dashboard helps managers review the projects and make further decisions. For an instance, this knowledge dashboard improves risk management of projects, managers balance the challenges and rewards of each project, and they decide whether continue the investments. In the pattern-oriented level, knowledge workers abstract reusable knowledge and patterns from projects.

Chapter 7 Conclusion and further study

7.1 Conclusion

The promises and missions of knowledge management are transfer organization's experience into its competitiveness, solidify knowledge that organization holding, and develop a competency knowledge that organization need. Knowledge management is to help staff learning from past, and others.

Tacit and explicit knowledge model is the basis of knowledge management theory. Tacit knowledge locates in minds, and explicit knowledge is codified content. Currently, most explicit knowledge is base on human language. The transfers between tacit and explicit knowledge are the essential part of knowledge management, a successful knowledge management cannot overlook tacit nor explicit parts. Although Knowledge management relates with many complex techniques, such as data/text mining, expert system, it is more social task than technical. People, the creator, discoverer, and user of knowledge, is the core of knowledge management. Knowledge fluxes in a loose-structured social network. Knowledge management is to shape this network and improve the knowledge transfers.

Knowledge Management has mutual affects with organizational culture. Organizational culture can be a barrier for knowledge management, but a good Knowledge Management can shape organizational culture also.

There are three important components if knowledge management system: knowledge repository, community of practice, and committee of expert. Knowledge repository is to store and manage all the explicit knowledge of an organization. Community of practice is an informal place for members share their knowledge and experiments; this community has many beneficial side effects: increase social capital and improve organizational performance. Committee of experts is a formal collaborative place. Committee of experts is more tasks oriented, its aim is to improve task management, team communication, and make knowledge with higher cohesiveness. The cohesiveness of knowledge becomes more and more important; a complete and cohesive knowledge competency is indispensably to enterprise's success.

In software industry, there are many mature products which could boost knowledge management projects. Enterprise content management and collaborative support software are the most useful software for knowledge management implementation.

Current knowledge management programs and projects are not suit for every enterprise, especially SMEs. But to those SMEs in knowledge-concentrated

industries, knowledge management could be an ideal solution.

7.2 Further study

Knowledge management has strong connections with other information system domains, such as workflow management, e-learning, and organization behavior. The further study will analyze those interconnected areas.

The further study also should focus on practice work. It is better than taking a deeper, longer research on real small and medium enterprise, and monitor long-term performance of a knowledge management system.

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Matematiska och systemtekniska institutionen
SE-351 95 Växjö

Tel. +46 (0)470 70 80 00, fax +46 (0)470 840 04
http://www.vxu.se/msi/