

Combination of Two KM Strategies* by Web 2.0

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Abstract. The previous approaches for KM focused on either of two main strategies: Codification or Personalization (which focused on explicit or tacit knowledge, respectively). Those approaches lead to serious problems, such as: difficulty for integration, inconvenience in knowledge accessibility, limitation of participation, disjunction of knowledge... The approach for solving those problems of this paper is to set up a new integrated platform for combining both strategies. That platform is based on web 2.0, a set of advanced technologies and a new approach to knowledge management. Using web 2.0 for knowledge management, both kinds of knowledge can be supported at the same time and knowledge creating cycle is also facilitated. In this paper, a KMS based on web 2.0 is specified and a demo system is implemented for testing this solution, which shows many advantages in comparison with previous KMS.

Keywords: KMS, KM Strategy, Explicit, Tacit, Web 2.0, Social Network.

1 Introduction

Nowadays, in the knowledge age, knowledge management is considered the best strategy to improve the performance and to strengthen the competitive capability of any enterprise. However, the implementation of KMS in practice is not so successful because of many reasons. The most important reason is that the enterprises have to choose to follow either of the two main KM strategies: Codification and Personalization. Recently, there are some efforts to balance those two strategies, but they meet another obstacle: lack of a suitable platform for the combination.

According to Hanssen et al. [7], there are two main strategies for KM:

- ◆ Codification: to systematize and store information that constitutes the company's knowledge, and to make this available to people in the company.
- ◆ Personalization: to support the flow of information in a company by having a centralized store of information about knowledge sources, like a "yellow pages" of who knows what in a company.

Codification strategy focus on explicit knowledge, while Personalization focus on tacit knowledge. Following just one strategy is proven to be not successful in reality, but combining those two strategies at a properly rate is considered a good solution.

* Two main KM strategies: Personalization and Codification.

According to Hanssen et al., most of companies that use knowledge effectively pursue one strategy predominantly (80%) and use the second strategy to support the first (20%). This showed the imbalance in utilizing two kinds of knowledge in problem solving and decision making, which required both of tacit and explicit knowledge. Can both kind of knowledge be supported equally at the same time? This can be done only if there is a suitable technology for KMS, which can support both kinds of knowledge. Using a suitable platform for knowledge management, both KM strategies can be followed at the same time. This solution ensures the success of KMS implementation and improves the overall performance of the enterprise.

Recently, Web 2.0, which is famous for social networking, is not only ideal platform for creating cooperative knowledge, but also for sharing and communicating between users. It could be used to create a web-based KMS, where explicit knowledge could be searched from a codified knowledge-base and available experts could be found and communicated with to find solutions for a problem. Such platform can satisfy requirements of both strategies.

Therefore, the purpose of this paper is exploring the ability to use web 2.0 in combining two KM strategies and suggesting a solution for KMS implementation based on web 2.0. This paper is organized as follows: (2) Problems of previous knowledge management approaches; (3) Approach for solving those problems; (4) Apply web 2.0 for building a KMS; (5) Demonstration and evaluation of the KMS based on web 2.0; (6) Conclusion and implications.

2 Problems of Previous Knowledge Management Approaches

2.1 Typical Techniques/Approaches of Knowledge Management

Traditional techniques and approaches for KM could be shown as follows:

Table 1. KM processes and the potential role of IT [1]

KM processes	Knowledge Creation	Knowledge Storage/ Retrieval	Knowledge Transfer	Knowledge Application
Supporting IT	Data mining Learning tools	E-bulletin boards Knowledge repository Databases	E-bulletin boards Knowledge directories	Expert systems Workflow systems
Platform technologies	Groupware and communication technologies Intranets/ Web 1.0			

Table 2. Previous Typical Knowledge Management approaches [4]

System	Description	Strategy
Expert Finder	Expert finder is a tool that can be used to identify and contact the relevant expert in problem solving process. It is usually build on a database in which the expert's profile including a description of his knowledge domain stored.	Personalization
Virtual Teamwork	Virtual teamwork refers to work conducted by a team consisting of geographically dispersed members usually enabled through IT support.	

Table 2. (continued)

Lessons Learned Database	Lessons learned refers to a concept that deals with the documentation and preservation of positive as well as negative experiences which occurred in practical situation in problem solving process in order to ensure their reutilization respectively their future prevention.	Codification
Case Based Reasoning	Case based reasoning (CBR) is a concept describing a problem solving process based upon the solutions of previous similar problems. For that reason a database is created with past cases including respective solution. Those cases could be searched & adapted later for similar situations.	
Virtual/Augmented Reality	Virtual reality (VR) refers to an environment simulated by computers as a general term whereas augmented reality describes the use of see-through displays to enable computer generated images to be overlaid on top of the user's view of the real world. This technology can be used to support or assist human actors in certain kinds of knowledge processes through visualization of e.g. instructions.	

2.2 Significant Problems of Previous KM Techniques/Approaches

Problems of previous techniques for KM could be as follows:

- A. *Diversity data sources*: previous techniques use independent data sources (database, data store, data warehouse), which is hardly to be converted or transfer through various phases of knowledge processing. This leads to the difficulty in sharing knowledge throughout the enterprise.
- B. *Difficulty for integration*: previous techniques are not suitable for integrating many kinds of business application services, which is required in building an effective KMS. It is difficult to integrate many services with various purposes into the same environment without vast changes in structure and data.

Problems of previous approaches for KM could be as follows:

- C. *Inconvenience in knowledge accessibility*: knowledge accessibility is not convenient to all of employees. For example, Expert Finder lets employee access to knowledge through experts, who are not always available; Virtual Teamwork through cooperating of group's member in problem solving; Case Base and Lesson Learned through database of previous situations; Virtual Reality let people access to knowledge for training only.
- D. *Limitation of participant*: previous approaches do not allow broadly participation of employees in knowledge accumulation process. For example, above approaches accumulate knowledge from a few experts, employees, who are selected for problem solving. Moreover, some democratic mechanism for getting public feedback, such as: voting, rating..., is not used frequently.
- E. *Disjunction of knowledge*: Expert finder and Virtual Teamwork follow Personalization strategy, which is only focus on tacit knowledge located inside experts' head; while other approaches follow Codification strategy, which is only concentrate on explicit knowledge. In fact, tacit knowledge and explicit knowledge are both required in problem solving or decision making.

3 Approach for Solving Those Problems

3.1 Necessity of Combination and Integration for Solving Those Problems

The main cause of those problems is in the strategic aspect of those approaches. There exists a trade-off strategy of focusing on either tacit knowledge or explicit knowledge. It is shown in the division between two main KM strategies: Personalization and Codification. Personalization strategy aims to handle tacit knowledge by locating someone who knows, point the knowledge seeker to that person, and encourage them to interact. In contrast, Codification strategy focuses on explicit knowledge by capturing and codifying knowledge for reusing.

Although in some cases or in a short period, tacit knowledge seems to be more important than explicit knowledge or vice versa, but in whole enterprise context or in a long period, a combination of both kind of knowledge will increase the effectiveness of business works and bring back long-term benefits. Therefore, tacit knowledge and explicit knowledge should be considered equally in KM strategy of any enterprise. According to Choi et al. [3], integrating explicit-oriented with tacit-oriented KM strategies is found to result in better performance of the enterprise.

Besides, according to Prof. Nonaka [8], knowledge creation is a spiraling process of interactions between explicit and tacit knowledge. Based on Nonaka's SECI model, two main strategies of knowledge management are realized to focus on two different parts of knowledge creating cycle. Codification focused on Externalization and Combination, whereas Personalization focused on Internalization and Socialization. This separation is the main reason for unsuccessful KMS implementation because a complete knowledge creating cycle is not established. Therefore, the combination of two main strategies of KM is very necessary in building a successful KMS.

However, if enabling techniques for KMS could not be integrated, the flow of information, knowledge between processes and between people could not be established. Therefore, it will prevent the interaction and combination between tacit and explicit knowledge. In order to make this combination success in practice, a suitable platform for integrating data, information, knowledge and applications is very important.

Moreover, the vast change of technologies for KM today requires a unique platform for integrating various types of information, tools, and applications in building a stable KMS. In the globalization, a need for transferring knowledge throughout the world will increase, so that a suitable technical platform for integration of many kinds of information and knowledge is a requisite for the success of any KM strategy.

3.2 Approach for Solving Those Problems

From above analysis, there are two main causes for those problems: disjunction of knowledge and disintegration of technology. In order to solve those problems, a platform is needed to integrate various data sources/ applications and to support both kinds of knowledge. In this paper, web 2.0 is selected as a solution because:

- It can be used for integrating data, information and applications.
- It encourages users' participation and contribution.
- It is suitable for sharing both kinds of knowledge (tacit and explicit).

Besides, according to a paper of O'Donovan et al. [9] about the key success factors in KMS implementation, three main factors of IT which have most effects on the success of KMS are: Ease of use, Security and Openness, and User involvement. These requirements can be satisfied easily by using technical platform based on web 2.0.

According to Smith [10], the three anchor points for Web 2.0 are:

- ◆ *Technology and architecture*: including the infrastructure of the Web and the concept of Web platforms. Examples of specific technologies include Ajax, representational state transfer (REST) and Really Simple Syndication (RSS).
- ◆ *Community and social*: looks at the dynamics around social networks, communities and other personal contents publish/share models, wikis and other collaborative content models.
- ◆ *Business and process*: Web services-enabled business models and mashup¹/remix applications. Examples: advertising, subscription models, software as a service (SaaS), and long-tail economics. A well-known specific example is connecting a rental-housing Web site with Google Maps to create a more useful service that automatically shows the location of each rental listing.

The first two anchor points show that web 2.0 can be used as a platform for integration and a social network for attracting users' participation. The last anchor point shows that web 2.0 can be used as a business model, but how it can support the combination of tacit and explicit knowledge is not known. In order to prove that web 2.0 can support both kinds of knowledge, the following case studies about current outstanding web 2.0 services are used. Most of those services can support both of Codification strategy (capture and reuse explicit knowledge) and Personalization strategy (handle tacit knowledge by communication and collaboration).

Table 3. Web 2.0 as a platform for supporting Codification and Personalization

Service	Codification supporting	Personalization supporting
Wikipedia (wikipedia.org)	<ul style="list-style-type: none"> - This online encyclopedia is the work of the crowd. - It is the biggest encyclopedia in the world. - Anyone can edit any item. - Any work can be rolled back. - The knowledge quality is controlled by a set of rules - The success of this service is on user-participation. 	<ul style="list-style-type: none"> - This environment could be used for creating a list of experts in each subject - Discussion is allowed for participators to exchange ideas
Delicious (del.icio.us)	<ul style="list-style-type: none"> - Bookmarks for all useful resources on the internet. - A live storage of cooperative knowledge. - Easy for searching a topic because of folksonomy. - Easy to add, edit a bookmark and share with other people. 	<ul style="list-style-type: none"> - Bookmarks to experts based on their professional. - Run add-in applications for communicating with people in the community.
YouTube (youtube.com)	<ul style="list-style-type: none"> - This video library is a very useful resource on web. - Number of uploaded videos increases day by day. - Video is uploaded, viewed and downloaded easily. - Videos are classified into categories and channels. - Quality of videos based on rate, view and comment. - Quantity and quality of video attract more or less user. 	<ul style="list-style-type: none"> - Users can subscribe for any channel that he/ she likes. - Commenting and rating are ways for communicating or discussing between users. - By the time, users with good channel will attract more people. They could be experts in a subject.

¹ Mashup - a Web site or Web application that combines content from more than one source.

Table 3. (continued)

<p>GoogleMap (maps.google.com)</p>	<ul style="list-style-type: none"> - A useful tool for searching any location in the world map. - Users can create their own map, mark, take note and draw on that map... - Map could be view in many forms, and could be attached with pictures, descriptions... - This service could be combined with other services, such as: real estate, traffic... 	<ul style="list-style-type: none"> - User's map can be shared with friends as directions. - Especially useful in finding an expert in real world. - Expert network could be created with links to their homepage, their knowledge or online presentation to communicate with.
<p>FaceBook (facebook.com)</p>	<ul style="list-style-type: none"> - Collection of profiles, pictures, notes, friends, videos, events, links and so on. - Allow add-in applications to be run and shared. - Easy to keep up with any change from friends by RSS, e-mail. - Support for trace of log in, comment, message... 	<ul style="list-style-type: none"> - Ideal environment for friend making and socializing. - Support mailing and chat system for communication between users. - Easy to search for friends based on their profiles.
<p>YahooAnswer (answers.yahoo.com)</p>	<ul style="list-style-type: none"> - Questions and answers are accumulated through the time by user participation. - Quality of answers based on rating and pointing system. - Questions are classified into categories for searching later. - Anyone can answer any question in allowed period. 	<ul style="list-style-type: none"> - User can ask for more detail of a question by giving many answers. - Rating is the feedback information for an answer. - User with high rank and good answers will get more appreciate from other users in community.
<p>Blogspot (blogspot.com)</p>	<ul style="list-style-type: none"> - Allow bloggers to write anything they like. - Easy to embed picture, audio and video. - Accept comment for each blog entry or whole blog. - Tag system help searching easier. - Bookmarks are also used to save useful links. 	<ul style="list-style-type: none"> - Store information about blogger for friend searching. - Easy to follow a blogger, make friend and contact directly.

However, web 2.0 services are different from a KMS in following aspects:

Table 4. Web 2.0 services vs. Knowledge management system

	Web 2.0 services	Knowledge management system
Function	Independent services	Integrated functions/ processes
Focus	Individual content	Organizational knowledge
Purpose	General purpose	Specific purpose for KM/ problem solving
Participants	Public	Staffs, Experts, Partners
Data quality	Unverified and low quality	Verified and high quality
Motivation	Rich content, Large community	Ease of use, Effectiveness

4 Apply Web 2.0 for Building a KMS

4.1 Solutions for Problems in (2.2) Based on Web 2.0

Based on above analysis, web 2.0 is realized to be able to play an important role in solving problems of KMS implementation by providing an integrated environment for both KM strategies. But web 2.0 only cannot satisfy requirements of a KMS, so that, a new KMS based on web 2.0 is needed to solve problems of KMS implementation by taking advantages of web 2.0. In fact, using web 2.0, all problems of KMS implementation in (2.2) can be solved completely as shown in the following table:

Table 5. Web 2.0 as a solution for KMS implementation problems

Problem	Solution
A. Diversity data sources	XML technology, core of web 2.0, could be a solution for this problem. All kind of data source now can be converted and transferred easily on web 2.0 through XML technology. Besides, semantic web also make data become more understandable and sharable between many systems and users.
B. Difficulty for integration	Web 2.0 platform allows many software applications to be integrated easily by using IDE (integrated development environment) and a lot of open source toolkits. With mash-up environment, user can do many things, such as: mail check, instant chat, view stock quotes, view temperature or read newspaper... on the same web screen.
C. Inconvenience in knowledge accessibility	With web 2.0, employees through out the enterprise can access to knowledge source from anywhere and at anytime to use it in problem solving as well as get benefits from learning general knowledge. They can also contribute their own knowledge to open problems. Knowledge can be classified in tags system and displayed in visual forms.
D. Limitation of participant	Web 2.0 requires the participation of many people. The more participation, the more valued knowledge could be gained. Wiki environment allows people to read and write about anything as well as discuss and rate on other people's writings. In this environment, everyone could be a potential expert.
E. Disjunction of knowledge	Web 2.0 environment is very suitable for the combination of both strategies of knowledge management. It focuses on both tacit knowledge (communicating, socializing, cooperating...) and explicit knowledge (stored experiences, cases, guides...).

4.2 Combining Two Main KM Strategies Based on Web 2.0

Not only solving problems of previous KM approaches, web 2.0 can also help facilitating knowledge creating cycle as in following concept model:

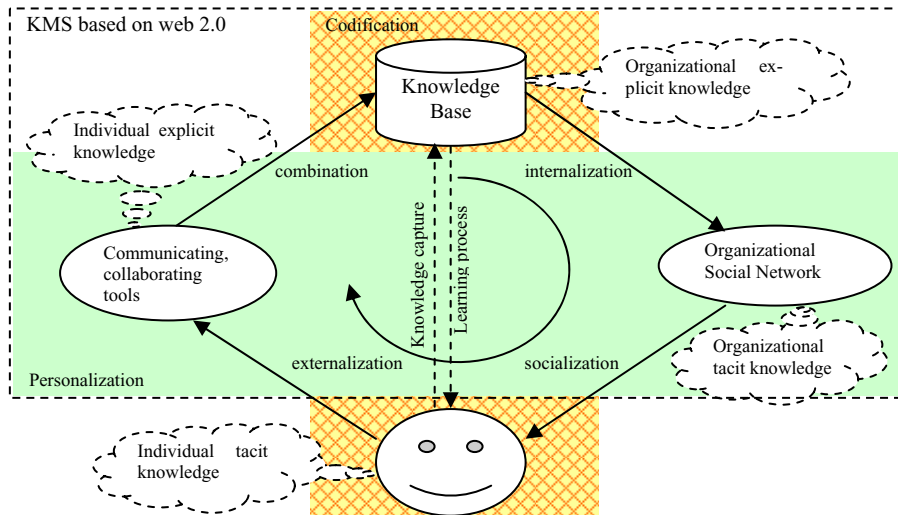


Fig. 1. Concept model of a KMS combining both KM strategies by web 2.0

In this model, web 2.0 can contribute to KMS implementation in two aspects:

- ◆ Create knowledge base for knowledge capturing and sharing (supports Codification strategy by storing explicit knowledge for searching and reusing).
- ◆ Create environment for collaboration, communication and social networking (supports Personalization strategy by allowing employees to access tacit knowledge of other experts or employees).

From above figure, a combination strategy is suggested based on web 2.0, in which both tacit knowledge and explicit knowledge are supported at a balanced rate. Besides, through communicating tools and organizational social networks, a complete knowledge cycle is established: individual tacit knowledge -> individual explicit knowledge -> organizational explicit knowledge -> organizational tacit knowledge.

An example of knowledge creating cycle is facilitated through this system:

- ◆ Leaders' intentions for operational improvement or new problems that need to be solved are published on organizational social network (notice board, blog's stories, online and offline meetings...) => this socialization process converts organizational tacit knowledge into individual tacit knowledge.
- ◆ Employees' response to those intentions or problems by asking for more information, telling their ideas or comments, submitting relating analysis, report... => this externalization process converts individual tacit knowledge into individual explicit knowledge.
- ◆ Through communication and collaboration tools, those explicit knowledge are classified, arranged, and stored in a logical order for referring, discussing and choosing final solution for initial intentions or problems => this combination process turns individual explicit knowledge to org. explicit knowledge.
- ◆ Using organizational explicit knowledge of previous cases in knowledge base as lessons for other divisions throughout the enterprise (through assessment, award system, blog's stories...) could inspire new intentions or find new similar problems to be solved based on previous cases => this internalization process converts org. explicit knowledge into org. tacit knowledge.

Moreover, individual tacit knowledge (of experts/ employees) can be codified and stored in knowledge base directly through knowledge capture process, and employees can also get benefits from the knowledge base through searching and self-learning process. This helps enrich the organizational knowledge base by importing previous lessons learnt from experts/ employees in addition to using knowledge cycle. Besides, this also helps to train new employees by using the knowledge base.

4.4 Framework for a KMS Based on Web 2.0

According to above analysis, a framework for applying web 2.0 in building up a knowledge management system (KMS_W2) is proposed. This framework includes general architecture, knowledge source, people, and processes as follows:

- Architecture: KMS_W2 is an integrated environment based on web 2.0 platform. The architecture of KMS based on web 2.0 is shown in figure below.
- Knowledge Source: a combination of operational database, data-warehouse, document base, content base, knowledge base and expert directory. Knowledge

base is used to store codified knowledge which includes problem, cause, related discussion, final solution and hyperlinks to references. The quality of knowledge-base is ensured by knowledge officers and through voting mechanism of system. Moreover, to access tacit knowledge, an updated list of experts with their profiles, experiences and contact information is collected and stored in expert directory.

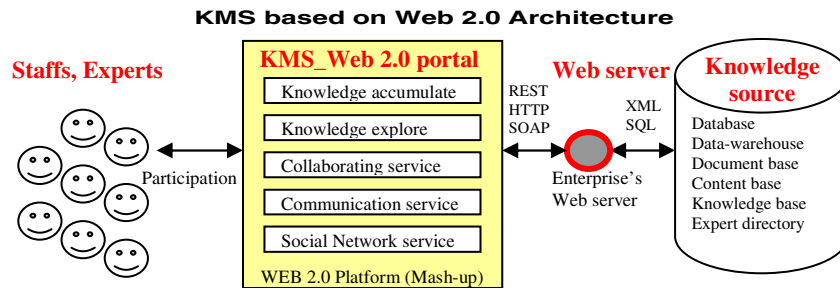


Fig. 2. Architecture of KMS based on web 2.0

- *People and Processes:* With this KMS_W2 portal, employees can log on and do their daily works with online applications, communicate with inside/outside partners, searching for solutions related to their problems, cooperating for problem solving, sharing ideas, voting for group decisions and learning new knowledge from a public knowledge base. Moreover, external users, such as: customers, partners, experts... are also encouraged to use this system. The following use-case diagram shows processes and people of KMS_W2:

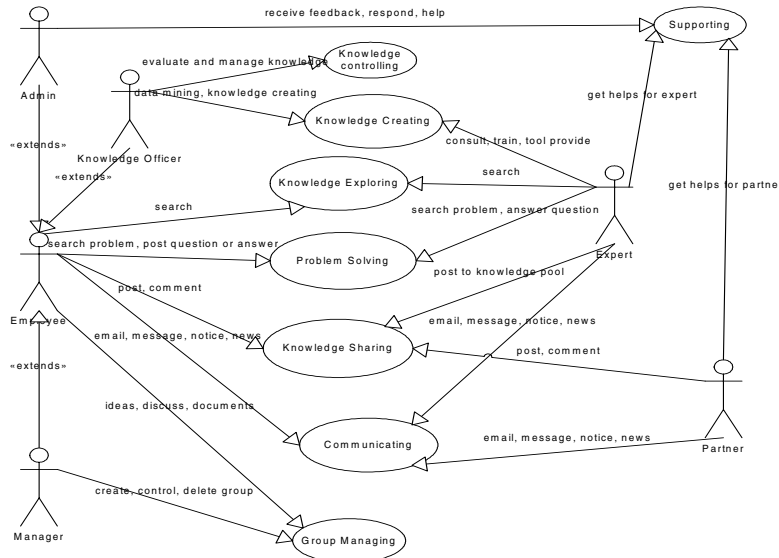


Fig. 3. Use-case diagram of proposed KMS based on web 2.0

The following table shows functional capabilities of KMS_W2:

Table 6. Functional capabilities of some Web 2.0 services and KMS based on Web 2.0

Functions	Wiki pedia	Delicious	You Tube	Google Map	Yahoo Answer	Face book	Blog spot	KMS_Web2
Profile					X	X	X	X
Friend making			X			X	X	X
Chat						X		X
Comment	X		X	X	X		X	X
Rating/ Marking		X	X		X			X
Mail			X			X		X
Notice board			X		X	X	X	X
Group managing	X					X		X
Discussion	X					X		X
Blog							X	X
Wiki	X							X
Questioning	X			X	X			X
Upload multimedia			X					X
Channel/ Subscribe			X					
Bookmark	X	X		X			X	X
Map/ GIS				X				
RSS		X					X	X
Mash-up				X		X	X	X
Tagging		X					X	X
TPS/ OAS/ MIS								X
DSS/ OLAP								X
Data Mining								X

5 Demonstration and Evaluation of the KMS Based on Web 2.0

In order to understand how this system works, a demo system is implemented based on an open source code of web 2.0 (from www.elgg.org). The environment for testing server includes: Windows Vista OS., Apache web server, My SQL DBMS and PHP programming language. Requirement for client environment is networked PC with a Web browser (such as: Internet Explorer or Mozillar Firefox). Knowledge source is mainly stored in My SQL database, but some kinds of knowledge object, such as: file, video, audio... are stored in a local folder or a link to embedded object on the internet. Testing system is an intranet website, which can be accessed through the following URL: <http://dev.oq.la/elgg1.5/> (See appendix for details).

From this prototype system, suggested KMS and its functions, which are implemented (black) or not implemented (blue, italic), are shown as follow:

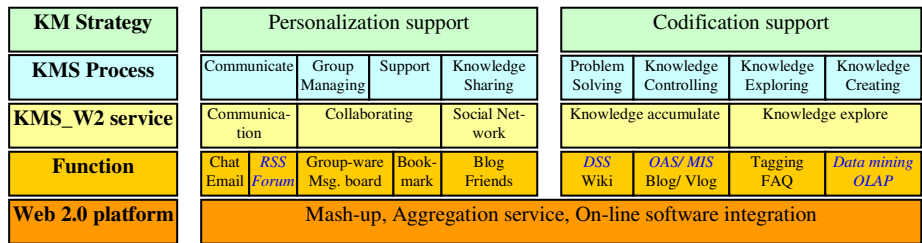


Fig. 4. Demo of KMS based on web 2.0 for supporting both KM strategies

In this system, the following knowledge management processes are also supported:

- ◆ *Knowledge accumulation*: this process is strongly supported by blog, wiki...
- ◆ *Knowledge evaluation*: this process is supported by voting, commenting...
- ◆ *Knowledge sharing*: knowledge is shared by organizational social network.
- ◆ *Knowledge utilization*: tag, chat, group... for searching and using knowledge.

Using this system, the interaction between employees and experts is encouraged through communication and collaboration. By the time, tacit knowledge will be captured more and more. This is an automatic knowledge extraction method. The consistency of knowledge is ensured by the voting mechanism with various weights for employees, experts and knowledge officers. However, users have the right to possess and to share their knowledge by setting “what will be shared with whom” to protect their privacy. In the enterprise context, ‘public’ sharing level is encouraged by many policies, such as: awards, compliments, incentives based on contribution...

In general, this system is better than previous solutions in the following aspects:

Table 7. Significant benefits of KMS based on Web 2.0

Benefits	Reasons
This system can be deployed quickly and easily with the support of open source code or renting services.	Without web 2.0, integration of just a function required a lot of time and cost. With web 2.0 platform, it is as simple as installing a software.
Users play active role in developing their own working environment. Functional extensibility is allowed according to users’ need. This characteristic will attract users for participation and contribution.	With a little training, users can easily add new available tools to their screen or manage their knowledge and chat with friends in their networks. They are free in doing their jobs here.
It is convenient for employees as well as managers to access explicit and tacit knowledge through social network and knowledge base of this system.	Tacit knowledge can be converted to explicit knowledge in many ways and stored in knowledge base for reusing by others in a later time.
This system decreases communication and collaboration cost, therefore increases the effectiveness of any project taken place inside the enterprise.	It is easy to communicate with other friends in one’s networks. Group service makes it easy for discussing, sharing and collaborating.
Using this system, the managers can easily monitor their human resource through analyzing the activities’ log. They can also make suitable policies or decisions for improving the company performance.	Activities’ log helps managers in monitoring their employees. Organizational social network can be used to convey ideas, to give advice... Admin tools help them to change system policy.

In summary, KMS based on web 2.0 has the following advantages:

Table 8. Advantages of KMS based on Web 2.0 and things to be done

Advantages confirmed	Things to be done
<ul style="list-style-type: none"> - It supports both of Codification and Personalization strategy of KM. - It facilitates activities for creating a complete knowledge cycle between tacit and explicit knowledge of individual and organization. - It turns a KMS into a multi-purpose system for problem solving, decision making, social networking and knowledge exploring. - It improves enterprise’s overall performance, brings benefits to all members by facilitating their jobs and broadening their knowledge. 	<ul style="list-style-type: none"> - This system only cannot change the operational habit of the enterprise. It could be adopted in parallel with adapted business processes. - A suitable culture for sharing knowledge is a necessary. The effective assessment and incentive system could help creating sharing culture, which is very important in the success of this system. - Security problems should be considered carefully when this system is implemented in practice, especially when outside partners are allowed to join or renting services are used.

6 Conclusion

In general, implementing a KMS effectively requires a proper strategy for KM. Most of the previous KMS were not successful because they focused on either of two main strategies for KM (Personalization or Codification). The division between tacit and explicit knowledge of two strategies is the main cause of problems in KMS implementation. This paper found that web 2.0 can be used as a platform for combining two main KM strategies in utilizing both kinds of knowledge.

The combination of two strategies for KM by web 2.0 helps to facilitate the knowledge creating cycle inside the enterprise and to provide an open environment for integration, which can be used for many purposes, such as: problem solving, decision making, social networking and knowledge exploring. This combination strategy ensures the effectiveness of KMS and improves the performance of the enterprise.

Moreover, a new KMS based on web 2.0 is suggested in detail and a demo system is tested in practice. This demo shows many advantages in comparison with previous systems. It also creates the creative environment and ensures the democracy in the enterprise, where knowledge is created, accessed and evaluated easily by everyone.

Besides many advantages, there are also some things to be implemented of a real KMS based on web 2.0. Some implications for the future works are as follows: analyzing cultural and organizational problems in deploying such system in the enterprise in practice; more detailed specification and evaluation of the system, especially focusing on the security aspect.

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Appendix

Dashboard of demo (<http://dev.oq.la/elgg1.5/>) - After logging in, employees can see the Dashboard, where most of useful tools are shown. All tools can also be called from menu Tools. Besides, employees can configure their environment display, notification method or privacy policy to their contents by using menu Settings. Menu Administration is shown only for admin to monitor, configure and make change to functions, users, policies and displays for the whole system. Search box is used for searching in knowledge base.



Profile page - This page allows users to update their own profile (personal information, hobbies, skills...), their knowledge (ideas, writings, messages, videos...) and their friendship (friends, groups, activities...). Those things can be shared with their friends by changing privacy setting to public/ limited mode.

