



Understanding Web 2.0 service models: A knowledge-creating perspective

Shari S.C. Shang^{a,*}, Eldon Y. Li^{a,1}, Ya-Ling Wu^{b,2}, Oliver C.L. Hou^{a,1}

^aDepartment of Management Information Systems, National Chengchi University, No. 64, Sec. 2, Zhi-Nan Road, Wenshan District, Taipei City 11605, Taiwan, ROC

^bDepartment of Information Management, Tamkang University, No. 151, Yingzhuang Rd., Danshui Dist., Xinbei City 25137, Taiwan, ROC

ARTICLE INFO

Article history:

Received 21 June 2009

Received in revised form 13 July 2010

Accepted 1 January 2011

Available online 11 May 2011

Keywords:

Web 2.0 service model

Knowledge management

Knowledge-creating cycle

Control mechanism

Platform pattern

ABSTRACT

We examined Web 2.0 services that provide different levels of knowledge exploitation and developed a framework for classifying existing service models from a knowledge-creation perspective. More than 1000 Web 2.0 application sites were analyzed and classified. We termed the two types of service platforms: Experience-Socialization and Intelligence-Proliferation. These involved four types of service models that we termed as Exchanger, Aggregator, Collaborator, and Liberator. These models show the diversity of existing Web 2.0 applications and provide a framework for a better understanding of operating patterns and value propositions within the Web 2.0 paradigm.

© 2011 Elsevier B.V. All rights reserved.

1. Introduction

Web 2.0 is a network platform on which peers contribute to the development of tools, content, and communities on the Internet. It was phrased during a discussion on technology-enabled business models in a brainstorming session of a 2005 conference between Tim O'Reilly and MediaLive International [7]. The term *Web 2.0* was intended to distinguish activities from traditional static and passive Web pages as a paradigm of dynamic and interactive knowledge creation on the Internet. On such a platform, users were expected to be able to draw from and contribute to knowledge databases simultaneously. The approach has been broadly used to harness collective intelligence that enriches user experience, provides a unique and hard-to-replicate source of information, but is disruptive to traditional markets.

Since Web 2.0 utilizes highly interactive Web 2.0 technologies and allows user participation in various ways [14], several innovative Web 2.0 service models have emerged, including Wikipedia and Facebook. Knowledge flows in both directions, and can be triggered by individuals from any location at any time. The Web platform acts as an intelligent broker, fostering cooperation

and shifting knowledge control from platform providers to widely dispersed users.

With the rapid increase of communication technologies and social software applications, various Web 2.0 platforms are being invented by using different combinations of databases and social networks to stimulate user interaction [12]. Meanwhile, contemporary businesses are facing more and more usage of Internet and Web 2.0 technologies among customers. Firms need to understand how Web 2.0 impacts knowledge management and how the user learning process can be leveraged as a strategic source for service growth and sustained advantage.

Although people can go through the whole learning process of Socialization–Externalization–Combination–Internalization (SECI), various Web 2.0 services have been developed to provide ways to support different stages of this process. The objective of our study was to develop a framework to classify such services. We adopted a knowledge-creating perspective to define different types of service models by analyzing the activities of Web 2.0 applications.

2. Literature review

2.1. Web 2.0 for knowledge-creating cycle

Web 2.0 technologies build a platform on which users can exchange information, express thoughts, and reconfigure existing explicit knowledge. Such a platform can lead to new and more complex knowledge. Adding an intelligent searching function enables agents and customers to identify needed content wherever it is stored. Such content includes real-time data retrieval from

* Corresponding author. Present address: No. 64, Sec. 2, Zhi-Nan Road, Wenshan District, Taipei City 11605, Taiwan, ROC. Tel.: +886 2 29393091x88085; fax: +886 2 29393754.

E-mail addresses: sshang@nccu.edu.tw (Shari S.C. Shang), eli@nccu.edu.tw (E.Y. Li), joanneuw@mail.tku.edu.tw (Y.-L. Wu), 98356505@nccu.edu.tw (Oliver C.L. Hou).

¹ Fax: +886 2 29393754.

² Fax: +886 2 26209737.

many back-office systems. Hence, in addition to individual knowledge generation, a Web 2.0 platform emerges as a viable channel of knowledge building for general and discipline-specific communities [5].

Because Web 2.0 supports a personal, dynamic and social learning process, it can facilitate the knowledge-creating cycle that follows the learning process of SECI where explicit and tacit knowledge interact with each other in a continuous process [8,9]. With this process cycle, people create, analyze, and assimilate knowledge, resulting in the development of competence [3]. The four modes of knowledge conversion interact in the sequential spiral process of knowledge creation triggering the generation of community knowledge.

On a Web 2.0 platform, socialization occurs when individuals or groups share methods, understanding, experience, and skills through observation, imitation, practice, and participation in different social communities. The development of explicit concepts from tacit knowledge occurs through several modes of representation, including spoken or written words, images, video, and music; this is the result of such externalization. Some technologies, such as VoIP, e-mail, tagging, phone/video-conferencing, and instant messaging, support the process, which can include dialogues and discussions that capture context-rich knowledge when it is being created. In a combination stage, the platform then combines various components of explicit knowledge to systematize it and enter it into a community knowledge system. Some Web 2.0 technologies, such as RSS (Really Simple Syndication), Folksonomies, and Mashups, are good examples of combining and remixing knowledge to form new knowledge for the community. Finally, internalization is a process of systematically reflecting collective learning through actions and practices.

Web 2.0 functionalities, such as content editing and co-development, can provide platforms for co-creation among participants, enabling knowledge internalization through reflection on what has been learned.

Knowledge creation can be viewed as a bottom-up spiral process, starting with the sharing of tacit knowledge at the individual level and moving to crystallization of the knowledge at

the group level and then on to the organizational level [8,9]. Dynamic interactions between tacit and explicit knowledge can decrease the cost, enlarge the scope, and attract more members to the Web 2.0 platform. As depicted in Fig. 1, Web 2.0 services provide a platform that enables and enforces the full learning process among individuals and communities.

2.2. Defining the Web 2.0 service model

A firm supplies services to its customers with clear position in the value chain [4]. According to Applegate, Austin, and McFarlan [11], there are three main elements within a service model: *concepts, capabilities, and values*. The concept of service delivered is based on analyses of management factors, such as customer needs, technologies, services offered, and the position in the value chain. Capabilities include human resources, facilities, equipment, capital, infrastructure, processes, methods, and technology, from which a service organization develops its ability to deliver a service. The value of such a service is the return to customers. Higher perceived returns attract and retain customers while generating sustainable business growth. Based on the building elements of a service model, we chose three dimensions as the differentiators of Web 2.0 service models. The first, knowledge-creating cycle enabled, corresponds to the concept of *service delivered*; while the second, control mechanism, corresponds to *critical capabilities* required for managing the services. The last, customer value, refers to the *value gained* by customers.

- **Knowledge-creating (KC) cycle enabled.** This consists of the four conversion patterns of knowledge in the SECI concept—socialization, externalization, combination, and internalization. The spiraling process of interaction between tacit and explicit helps by creating knowledge (i.e., by building the knowledge management services) within the SECI value chain
- **Control mechanism.** This manages the knowledge-collecting and storing activities, thereby ensuring the effectiveness of knowledge acquisition, transformation, sharing, and application; it reflects one of the key capabilities required for managing a

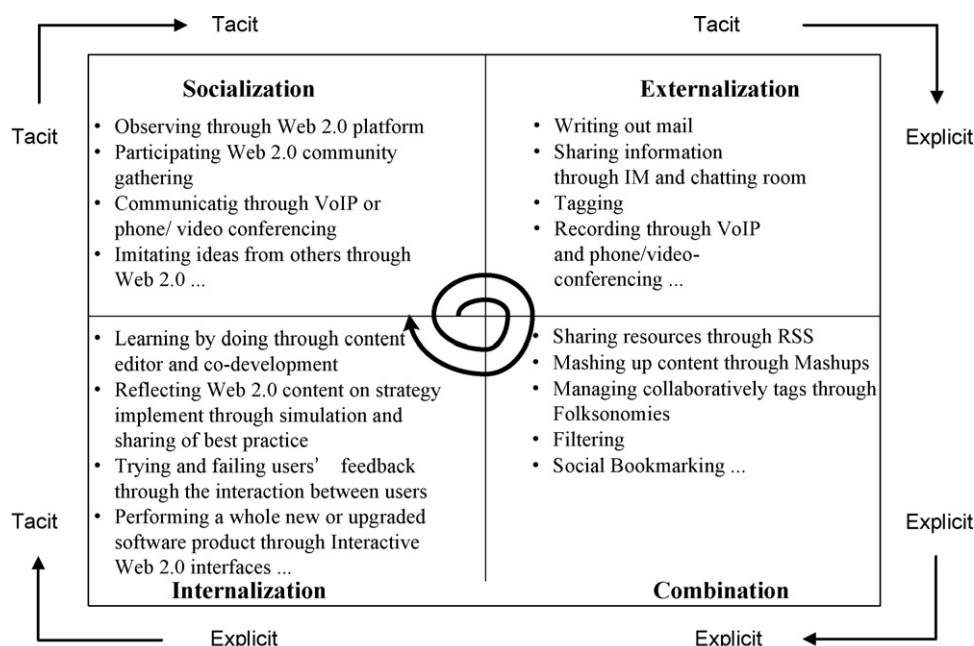


Fig. 1. The knowledge-creating cycle in Web 2.0 sites.

service model. Possible control mechanisms used by Web 2.0 companies include:

- Log: record user contents and activities into a history file;
- Frame: categorize user contents;
- Standardize: provide uniform knowledge sharing processes such as uploading, editing, and recommending content, verifying data accuracy;
- Systematize: develop a consistent processes of knowledge search, storage, exchange, transfer, and analysis for content sharing and reuse;
- Authorize: grant proper users' permission to access and review relevant content;
- Review: to see the content and ensure its quality and legitimacy.

For example, Wikipedia is an encyclopedia collaboratively written. To assure quality, it offers standardized procedures for users to edit content. To enhance the reliability, all editors must register as members in order to offer opinions on the correctness of any published article. To build traceability, all changes are recorded in article histories and change logs. Inappropriate changes are removed quickly, and repeat offenders can be blocked from further editing. To enhance the effectiveness of knowledge dispersion, its articles are arranged in systematic categories and offer search functions.

- **Customer value.** User learning processes can benefit from Web 2.0 features; this is enhanced through sharing, assimilation, regeneration, reinterpretation, and retention of knowledge and user skill upgrades. To identify combinations of service capabilities and knowledge creation, we selected KC cycle and

Table 1

The six types of service models.

Dimension type	KC cycle enabled	Control mechanism ^a
Type I	S → E	High
Type II	S → E	Low
Type III	S → E → C	High
Type IV	S → E → C	Low
Type V	S → E → C → I	High
Type VI	S → E → C → I	Low

^a Low control includes log, frame, standardization, and systematization; high control also includes authorization and review.

control mechanism dimensions. These two dimensions have a close link with technology adoption, capability building, and the fulfillment of knowledge-creating services. By applying all of the functionalities, a Web 2.0 platform can enable a knowledge-creating process from socialization to externalization. Due to different customer needs, the service provider may not choose to include the complete knowledge-creating process but may instead focus on socialization and externalization. These two processes allow individuals to share what they have learned in the form of conversation, photos, hypotheses, diagrams, models, or prototypes. However, some providers may choose to include the socialization, externalization, and combination processes without internalization. A high level of control may discourage socialization but a low level of control may result in a quality problem. Accordingly, we identified in Table 1, six types of service models that include different knowledge-creating services.

Table 2

Various Web 2.0 applications examined in this study.

Web 2.0 (total sites)	Description
Chat (124)	Chat Web sites establish Web-based communication among Web site users.
E-mail (59)	E-mail Web sites allow users to manage their e-mail accounts from any computer and offer a Web mail service with a number of features, such as connections with photos, tags, e-mail, and voice.
Bookmarking (65)	Bookmarking Web sites collect, organize, and share various types of content that users discover while browsing the Web.
Games (38)	Game Web sites provide a browser-based interactive game and allow players to compete against one another and share achievements and scores.
Wikis (13)	Wiki Web sites allow users to create and share content, Web pages, images, and much more in an instant through their browsers.
Travel (30)	Travel Web sites enable everyone to explore. Clients may want to share advice about local restaurants, or perhaps search the widest possible choice of airline flights and prices.
Video (156)	Video Web sites allow users to receive Internet videos.
Music (57)	Music Web sites are media-centric social networks in which users interact with one another by watching, posting, and sharing content of all media types, such as blogs, photos, audio, and video.
Programming (38)	Programming Web sites enable individuals to generate and share Web 2.0 content, code, or other Web applications with one another.
Office (43)	Office Web sites bring to the Web many of the powerful functionalities of office tools like MS Word.
Blogs (91)	Blog Web sites are social networks built around the telling of life stories.
Calls and VOIP (17)	Calls and VOIP Web sites allow users to call other people using IP software such as Skype.
RSS (68)	RSS (Really Simple Syndication) Web sites are Web-based, news-feed aggregators designed to allow users to read news from many sources.
Photo (99)	Photo Web sites provide online photo services allowing users to manage and share photos.
Network (115)	A network Web site is a social utility for connecting people with friends and others who work, study, or live around them.
Business (18)	Business Web sites can help an organization manage and share tasks—e.g., Web-based project management or financial management—in a team or group in an effective and transparent manner using management tools.
Web 2.0 tools (11)	Web 2.0 tools Web sites offer management tools (e.g., a unique tool to access and manage several DBs through a simple Web interface) through Web 2.0 sites.

3. Research method

To examine and categorize Web 2.0 services, we adopted a qualitative approach, which included a literature review, content review, and expert interviews. First, we reviewed the literature to identify elements of service value, operations, and capabilities to conceptualize the service model. We selected two dimensions, the *knowledge-creating cycle* and the *control mechanism*, as the criteria for classifying the service models.

The second stage of the process examined the cases through content analysis of information from the directory of 1042 Web 2.0 sites listed on AjaxProjects.com in 2008 (see <http://web2.ajax-projects.com/web2/>). The company surveyed almost all Web 2.0 sites (see Table 2), focusing on their applications, tools, and content. The sites were classified into different types of service models based on their key dimensions. Two rounds of case-content reviews were conducted. In the first, three reviewers, including one professor, one Ph.D. candidate, and one industry expert, analyzed and classified all the sites. Each was placed in one of the six types of service models. Reliability of the classification was measured by Holsti's interjudge agreement ratio [13]:

$$R = \frac{N(\text{average interjudge agreement})}{1 + [(N - 1)(\text{average interjudge agreement})]}$$

where N represents the number of evaluators (3 in the current study). Average interjudge agreement was calculated by the following formula:

$$\frac{(2M_{12}/(n_1 + n_2)) + (2M_{23}/(n_2 + n_3)) + (2M_{13}/(n_1 + n_3))}{N}$$

where N represents the number of judges (3 in the study); M represents the number of coding decisions upon which there is agreement between any two evaluators; and n_1 , n_2 , and n_3 represent the number of coding decisions by evaluators 1, 2, and 3, respectively. The agreement ratio can range from 0 (complete disagreement) to 1 (complete agreement); thus the first stage interjudge agreement of 0.93 indicated a high reliability of our assessment process.

In the second round of case-content review, reviewers discussed inconsistent results. Type I and Type III Web 2.0 service models were not found to exist in our sample of today's Web 2.0 communities. This is possibly because they do not go through the complete SECI process but only through $S \rightarrow E$ and $S \rightarrow E \rightarrow C$, respectively. Since their focus is mainly on accelerating knowledge socialization, they choose to let the knowledge remain volatile and apply low control mechanism to encourage user exploration. There were four kinds of Web 2.0 service models, including Type II, Type IV, Type V, and Type VI. These were labeled according to their service nature as Exchanger, Aggregator, Collaborator, and Liberator.

The third stage of our research verified the taxonomy of service models and consolidated our insights into the management and operations of the various models. The objective of this process was to validate the categorization of the models and elaborate on their customer values.

A group of ten industry experts were invited to join our study. They all had more than five years of experience in the management of electronic platforms and at least two years experience in diverse Web 2.0 applications. Their demographics are shown in Table 3. The heterogeneity of their backgrounds and experience with Web 2.0 services helped ensure the validity of our results. A feed-forward approach of the normal Delphi technique was used.

The four service models were presented to the experts with their descriptions and exemplary cases. An initial list of values was also identified from the literature review. The experts were then asked to verify the categorization of each service model, classify the value items into four service models, and add missing items. All participants agreed that the four service models and consolidated list of values were valid and consistent with their experience in managing Web 2.0 service sites.

Lastly, we asked participants to consider the resulting list and explain their implications for knowledge creation. The feed-forward runs were conducted by telephone and e-mail to reassess points of interest. Of the four services models, two types of Web 2.0 platforms were noted: experience-socialization and intelligence-proliferation. Opinions were consolidated to yield further implications that provided insights into the user learning and Web 2.0 service management. Finally, four kinds of Web 2.0 service models were derived (see Table 4).

4. Web 2.0 service models

Table 4 summarizes these four service models.

- **Exchanger:** This is a platform that enables knowledge socialization and externalization with a low control mechanism. It is usually a Web site that has instant-messaging functions to facilitate exchange of shared experiences via online communication. This kind of service provides a platform such as MSN or Skype that allows users to exchange information via written or voice messages. This peer-to-peer sharing is a form of externalization.

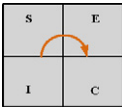
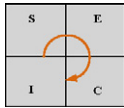
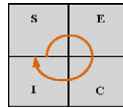
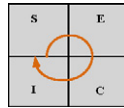
The content of an Exchanger is not systematized and organized. All Internet users who download and install the client program can use such a service, and any information can be sent or requested in real time. There are no quality assurances for the exchanged data. Users often share unconfirmed or private data, which are difficult to monitor. Accordingly, the quality of the contents on an Exchanger is relatively low.

- **Aggregator:** This is a platform that enables the knowledge-creating cycle from socialization and externalization to combine

Table 3
Characteristics of participants in expert interviews.

Expert ID	Managerial experience with Web 2.0 applications	Job title	Years of experience
A	Office, social networks, programming, Web 2.0 tools	Manager	3
B	Chat, music, photo, blogs, video	Project manager	2
C	Music, RSS, photo, blogs, video, social networks	Sales manager	2
D	Chat, e-mail, music, blogs, social networks	Director	3
E	Business, wikis, programming	System analyst	2
F	Chat, music, photo, blogs, video, social networks	General manager	4
G	Chat, music, photo, blogs, video, games	Manager	3
H	Wikis, social networks, bookmarking	Manager	3
I	Business, wikis, programming	Manager	3
J	Business, social networks, programming, Web 2.0 tools	Customer service specialist	2

Table 4
A classification of different Web 2.0 service models.

Model category	Experience-socialization platform		Intelligence-proliferation platform	
	Exchanger	Aggregator	Collaborator	Liberator
Web 2.0 applications (number of sites listed on AjaxProjects.com)	Calls & VOIP, chat, e-mails, networks (268 sites)	Blogs, bookmarking, music, photo, video, RSS, networks (613 sites)	Wikis, travel, bookmarking, business, office, programming, games (118 sites)	Business, office, programming, Web 2.0 tools, games (43 sites)
Dimension type Community knowledge- creating cycle enabled by Web 2.0 platform	Type II 	Type IV 	Type V 	Type VI 
Control mechanism	<ul style="list-style-type: none"> • Log 	<ul style="list-style-type: none"> • Log • Framing • Standardization 	<ul style="list-style-type: none"> • Log • Standardization • Systematization • Authorization • Review 	<ul style="list-style-type: none"> • Log • Standardization
Customer value	<ul style="list-style-type: none"> • Exchange of instant message or data • Extended social network 	<ul style="list-style-type: none"> • Share and retain information • Information sufficiency • Extended social network 	<ul style="list-style-type: none"> • Share, retain, assimilate, and regenerate knowledge under specific standards • Knowledge quality • Information sufficiency • Upgraded user knowledge and skill 	<ul style="list-style-type: none"> • Share, retain, assimilate and regenerate knowledge under free format • Knowledge reliability • Application flexibility • Upgraded user knowledge and skill
Exemplary cases	MSN, Skype	Twitter, Plurk, YouTube, Facebook	Wikipedia, Answers.com, Salesforce.com	OpenOffice, Linux

with low control mechanisms. Its Web site can aggregate syndicated Web content, such as news headlines, blogs, podcasts, and video logs, into a single location for easy viewing. It provides a storage platform, such as Facebook, YouTube, or Twitter, for sharing users' information in an allocated space that is easily accessible over the Internet. The rich knowledge, such as expertise, understanding, experience, and skills, is published by individuals in various ways (e.g., text, video, or audio), and knowledge socialization and externalization can be performed through technologies such as RSS and Mashups. However, such a platform does not provide ways to determine what has been learned from the combination.

An Aggregator's contents can increase exponentially if it attracts many users, who integrate the Aggregator into their daily practice. Thus, all users receive news and feedback quickly. In systems like MySpace, Yahoo Blog, or YouTube, the Aggregator only keeps posting logs and requests using a standard uploading process. There is no screening activity and consequently there is only low control of the quality of the created contents.

- **Collaborator:** This is a platform that enables the knowledge-creating cycle from socialization, externalization, through combination to internalization with high control mechanisms in place. On such a platform, the mode of internalized knowledge is reflected in two forms: recreated contents or recreated applications. The former provides functions for organizing complex information into specific categories and enables participants to review, edit, recreate, and generate contents. Answers.com, Salesforce.com, and Yahoo Widget are three examples which offer an API that allows its users to develop applications. These services enable a continuous knowledge-creating process from socializing and externalizing knowledge with peers through combining specific knowledge within a collective intelligence to reflecting the knowledge internalization through digitized content or applications.

Furthermore, it offers a systematic way to store and combine large amounts of knowledge via Mashups or APIs, and users can both store and share knowledge, post their own questions or

incomplete applications for joint development with others. If users think someone's contribution is not good, they can enhance its quality by posting comments and suggestions or customizing the applications via APIs. Each enhancement of the knowledge content reflects what has been learned from the knowledge-creating cycle. In the case of Wikipedia, viewers follow a standard process to create an account with editing rights. Log records of revisions for each article are stored. All articles are organized and categorized through hyperlinks within the content, which creates a systematized method for viewers to acquire related knowledge. Also, every change made must go through an approval process. There are several reviewing processes for feedback, and an Arbitration or Mediation Committee is included to resolve disputes. In sum, the control mechanism with Collaborators is relatively high because of the standardization, systematization, authorization, and review processes used in maintaining the quality of contents.

- **Liberator:** This is a platform that provides for the knowledge-creating cycle from socialization, externalization, through combination to internalization with low control mechanisms. These communities focus on opening their source code to scrutiny to allow upgrading of its quality. Taking OpenOffice and Linux as examples, users can share the applications they download, as well as revise and update them on the open-source community's Web sites. Furthermore, users can publish their usage experience, provide a new version, access free and open source code, create a new application, etc., and even design alternative solutions for other operating systems. Developers can offer their solutions to the communities without any restriction. The knowledge-creating process is similar to that of a Collaborator but the process is more open and dynamic.

The control mechanism in a Liberator is relatively low. Although its users log in and use standardization to organize content, there is no enforced review process with which developers share their solutions and revised code. The untested software and inconsistent versions can cause system crashes and mismatches among user applications.

As shown in Table 4, Type I and Type III do not exist in Web 2.0 communities. For services of a partial knowledge-creating cycle such as Types II and IV, a low control mechanism is applied by most of the Web 2.0 services. That is, Exchangers and Aggregators place little control over the quality of the knowledge created. This is possibly due to users' high intention of knowledge socialization and externalization combined with low intent to build structural knowledge for further exploitation; the knowledge processed is mainly for casual activities. No service site was found with a high control mechanism for partially completed knowledge-creating phases.

Type V and Type VI platforms, Collaborator and Liberator, offer a platform that enables the reflection of internalized knowledge. Based on systematized contents stored on the platform, users reconfigure and recreate knowledge. The services with full knowledge-creating cycle have both high and low control mechanisms. Through the full knowledge-creating cycle, the Collaborators of Type V not only create remixed knowledge in a text form but also produce re-mixed knowledge in a software form under the technical standards set by the service provider. High control mechanisms are in place to assure the quality, reliability, and reusability of the knowledge. However, low control mechanisms have also been noted within services using the full knowledge-creating cycle. The Liberators of Type VI place low control mechanisms on the remixing of knowledge, requiring each participant to assume the risk of knowledge inconsistency.

We further divided the four types of Web 2.0 service models into the following two types of platforms based on knowledge-creating patterns: one with no intention for sharing internalized knowledge and the other one with a systematic platform for reflecting the recreated knowledge.

- **An experience-socialization platform**, such as Exchanger and Aggregator, is mainly a platform with social-intensive support for users, and it usually applies experience-management tools such as Blog, a Bulletin Board, and a community platform. The experience-socialization platform was established mainly for exchanging and aggregating participants' experience. Knowledge internalization is not a concern of this type of platform. The content, which is generated by diversified users, is under no control mechanism to assure quality.
- **An intelligence-proliferation platform**, such as Collaborator and Liberator, is a platform for exploiting and regenerating knowledge in depth. The content is mostly reviewed by other users and/or system administrators, and these are mainly knowledge-based participants with similar contextual backgrounds. The collective goal of participation leans more toward a full knowledge-creating cycle within which knowledge combination, remixing, and the development of innovative applications are important focuses resulting in the creation of intellectual capital. The Web 2.0 technologies mainly support the continuous improvement of the knowledge content.

5. Leveraging Web 2.0 service models

As different Web 2.0 services evolve, participants have more opportunity to develop solutions and thus perform with higher potential. Under the different knowledge-creating cycles of Web 2.0 services, specific properties, such as user motivation, platform management, and knowledge-creating service portfolios, need to be addressed to improve knowledge creation.

- **User motivation.** Volunteer must be motivated to join an online community [10,16,17]. Due to their different focuses, their motivations differ. Users of the experience-socialization platform are in search of emotional experience in the platform, where community identification, human interaction, and per-

ceived enjoyment are important for the participants, who tend to have similar interests and are largely in agreement. Social opportunities for users to meet, share, discuss, and have fun are built to reveal the value of this type of platform. In contrast, users of the intelligence-proliferation platform join the platform more for intellectual-interaction. The perceived usefulness, community identity, and self-efficacy among participants with similar knowledge-based contexts are important motivations for their knowledge sharing. Collaboration opportunities for participants to work, contribute, cooperate, and further improve their knowledge and skills are important factors. To motivate a continuous knowledge-creating cycle, the results of collaborative efforts are distributed on these types of platforms to enhance positive outcomes and a sense of achievement.

- **Platform management.** Because platforms have different focuses, capabilities applied to facilitate the knowledge-creating cycle have distinctive features. The experience-socialization platform aims at developing an experience repository that can accumulate, exchange, share, and retain users' experiences, networks, and social support to sustain social cohesion. The management of this platform tends to aid users in deploying their social networks, to enhance linkages among participants, and to promote more useful experiences. On the other hand, knowledge-intensive platform management is aimed at the sharing, assimilation, and regeneration of structured knowledge. Its challenge is to organize the necessary knowledge and technology, expertise, and resources to support applications of knowledge services for effective learning [15]. The management of this type of platform tends to aid users in profiting from the knowledge and becoming better prepared to face new challenges. Hence, the key elements in an intelligence-proliferation platform are the creation of user demands, maintenance of the quality of the knowledge content and the system, and the establishment of standards and infrastructure for knowledge combination and regeneration. The improvement of knowledge quality requires the participation of users who must continuously distribute and articulate what they know. The development of control mechanisms to integrate these concerns into Web 2.0 platform management is one of the principal challenges to be met by organizational managers facilitating topic building in specific areas.
- **Knowledge-creating service portfolio.** Although each service model exemplifies unique characteristics, they are not mutually exclusive; a hybrid model that encompasses the two patterns of Web 2.0 services may evolve. Dell, for instance, transformed the use of the Web 2.0 platform from collecting customer feedback to collaborative product design [2]. Second life extended services from experience sharing into structural knowledge building [1,6], while Salesforce.com, which originally applied the Web 2.0 concept only for questions and answers, provides platforms for building software collaboratively around its core services [18]. Companies can benefit from a hybrid model to manage both internal employee socialization and knowledge aggregation and external knowledge creation with customers and business partners. A company that wishes to apply a collaborative integration system may need to have some functions of Exchanger and Collaborator (such as a chat room for the exchange of views and a Wikipedia-type platform for knowledge management). Due to the existence of different contextual environments for knowledge creation, the management of a hybrid service model requires a fundamental understanding of the nature and objectives of the knowledge-creating processes as well as involving the implementation of specific strategies for different arrangements of knowledge creation.

Given that a successful Web 2.0 platform must attract a considerable number of participants to solidify it as a rich learning,

knowledge-creating, and collaboration environment, a careful analysis of user motivations is required in order to leverage different types of service and continuously improve the platform, while dynamically managing the portfolio of the service models as they evolve.

6. Conclusion and recommendations

With the emergence of the Web 2.0 concept, knowledge-creating services are becoming more complicated and require different efforts from both customers and service providers. Although the application of Web 2.0 is in its early stage, with various applications still progressing, the knowledge-creating processes of the platform requires dynamic and contextual management for appropriate knowledge exploitation and to decrease the negative impact of the created knowledge. We identified four categories of Web 2.0 service models from two types of platforms. A categorization of the different practices within Web 2.0 platforms provides an abstract taxonomy of Web 2.0 services.

Our Web 2.0 service models can provide business executives with a roadmap of the adaptation of the emergent technology for aligning business objectives with different kinds of knowledge-creating services. The mapping and analysis of Web 2.0 service models with a knowledge-creating paradigm can facilitate the design of a firm's knowledge-creating portfolio by asking such questions as: What exactly are our value propositions and operating patterns of managing internal and external knowledge? What model(s) should we apply in delivering the intended value to our internal and external customers? What would be the most efficient way to exploit generated knowledge? Have we implemented mechanisms for controlling and monitoring the quality of the knowledge generated? Are we prepared with resources to manage the factors associated with this service model? The taxonomy of Web 2.0 service models we proposed has highlighted the salient features of Web 2.0 services because it clearly delineates how each model varies in its knowledge-creating requirements.

References

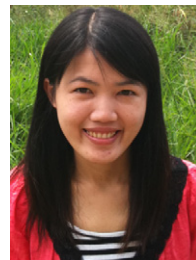
- [1] A. De Lucia, R. Francese, I. Passero, G. Tortora, Development and evaluation of a virtual campus on second life: the case of SecondDMI, *Computers & Education* 52 (1), 2009, pp. 220–233.
- [2] J. Fortt, Michael Dell 'friends' his customers, *Fortune* 158 (5), 2008, pp. 35–38.
- [3] F.L. Fu, Y.L. Wu, H.C. Ho, An investigation of cooperative pedagogic design for knowledge creation in Web-based learning, *Computers & Education* 53 (3), 2009, pp. 550–562.
- [4] N. García-crespo, R. Colomo-palacios, J. Gómez-berbís, B. Ruiz-mezcua, SEMO: a framework for customer social networks analysis based on semantics, *Journal of Information Technology* 25 (2), 2010, pp. 178–188.
- [5] G.C. Kane, R.G. Fichman, The shoemaker's children: using Wikis for information systems teaching, research, and publication (includes comments and editorial note), *MIS Quarterly* 33 (1), 2009, pp. 1–22.
- [6] T. Kohler, K. Matzler, J. Füller, Avatar-based innovation: using virtual worlds for real-world innovation, *Technovation* 29 (6–7), 2009, pp. 395–407.
- [7] M. Levy, Web 2.0 implications on knowledge management, *Journal of Knowledge Management* 13 (1), 2009, pp. 120–134.
- [8] I. Nonaka, G. von Krogh, S. Voelpel, Organizational knowledge creation theory: evolutionary paths and future advances, *Organization Studies* 27 (8), 2006, pp. 1179–1208.
- [9] I. Nonaka, R. Toyama, The knowledge-creating theory revisited: knowledge creation as a synthesizing process, *Knowledge Management Research & Practice* 1 (1), 2003, pp. 2–10.
- [10] C. Okoli, W. Oh, Investigating recognition-based performance in an open content community: a social capital perspective, *Information & Management* 44 (3), 2007, pp. 240–252.
- [11] P.B. Seddon, G.P. Lewis, P. Freeman, G. Shanks, The case for viewing business models as abstractions of strategy, *Communications of the Association for Information Systems* 13 (1), 2004, pp. 427–442.
- [12] A. Shen, M. Lee, C. Cheung, H. Chen, Gender differences in intentional social action: we-intention to engage in social network-facilitated team collaboration, *Journal of Information Technology* 25 (2), 2010, pp. 152–169.
- [13] C. Steinfield, T. Adelaar, F. Liu, Click and mortar strategies viewed from the Web: a content analysis of features illustrating integration between retailers' online and offline presence, *Electronic Markets* 15 (3), 2005, pp. 199–212.
- [14] S. Wattal, D. Schuff, M. Mandviwalla, C.B. Williams, Web 2.0 and politics: the 2008 U.S. presidential election and an e-politics research agenda, *MIS Quarterly* 34 (4), 2010, pp. 669–688.
- [15] H. Wu, M.D. Gordon, W.G. Fan, Collective taxonomizing: a collaborative approach to organizing document repositories, *Decision Support Systems* 50 (1), 2010, pp. 292–303.
- [16] C.G. Wu, J.H. Gerlach, C.E. Young, An empirical analysis of open source software developers' motivations and continuance intentions, *Information & Management* 44 (3), 2007, pp. 231–352.
- [17] B. Xu, D.R. Jones, B. Shao, Volunteers' involvement in online community based software development, *Information & Management* 46 (3), 2009, pp. 151–158.
- [18] S.X. Zhang, L. Olfman, P. Ractham, Designing ePortfolio 2.0: integrating and coordinating Web 2.0 services with ePortfolio systems for enhancing users' learning, *Journal of Information Systems Education* 18 (2), 2007, pp. 203–214.



Shari Shang is an associate professor of Management Information Systems at the National Chengchi University in Taiwan. Her professional expertise includes business innovation, business process management, enterprise systems (CRM and ERP), and strategic technology management. She received her Ph.D. in Information Systems from the University of Melbourne in Australia. Her research has been published in *Information Systems Journal*, *International Journal of Technology Management, Behaviour & Information Technology*, *Service Industries Journal*, and *Total Quality Management & Business Excellence*. Before undertaking her doctoral study, Dr. Shang worked as a Consulting Manager, MIS Manager, Business Analyst, and EDP specialist in global companies such as IBM, KPMG, and AICPA, in both Taiwan and the United States.



Eldon Y. Li is University Chair Professor and Director of Innovation and Incubation Center and Founder of Center for Service Innovation at National Chengchi University in Taiwan. He was Dean of College of Informatics and Director of Graduate Institute of Social Informatics at Yuan Ze University in Taiwan, as well as Professor and Coordinator of MIS Program at the College of Business, California Polytechnic State University, San Luis Obispo, CA, USA. He visited the Department of Decision Sciences and Managerial Economics at the Chinese University of Hong Kong during 1999–2000. He was the Professor and Founding Director of the Graduate Institute of Information Management at the National Chung Cheng University in Chia-Yi, Taiwan. He received his Ph.D. from Texas Tech University in 1982. He has published over 140 papers in various topics related to innovation and technology management, human factors in information technology (IT), strategic IT planning, software quality management, and information systems management. He is the president of International Consortium for Electronic Business and Asia Pacific Decision Sciences Institute in 2007–2008.



Ya-Ling Wu is an assistant professor in the department of Information Management at Tamkang University in Taiwan. She received her Ph.D. in Management Information Systems from National Chengchi University in 2010. Ya-Ling's major research areas are Service Management and Innovation, Knowledge Management, Online Behavior and E-business. Her research has been published in the *International Journal of Human Resource Management*, *Asia Pacific Management Review*, *Computers & Education*, and *Service Industries Journal*, among other journals.



Oliver C.L. Hou is currently a Ph.D. student in the department of Management Information Systems at National Chengchi University. Oliver's research interests include Software Engineering and Quality, Web 2.0 and E-business. He also has over 15 years of experience in software development and package implementation, especially in the financial sector.