# 行政院國家科學委員會專題研究計畫 成果報告

## WEB 2.0 知識價值創造之研究
## 研究成果報告(精簡版)

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# 行政院國家科學委員會專題研究計畫成果報告

## WEB 2.0 知識價值創造之研究
## An Investigation of Knowledge Creation with Web 2.0 Services

## 一、 中文摘要

Web 2.0的核心概念是指使用者可以透過雙向的互動機制，在網際網路上運用、分享、以及建構資訊、軟體甚至應用工具。這樣的概念運用之下，使用者的知識分享意願亦會受到平台中的知識與流程(即Web 2.0選擇權)所影響，因此，使用者參與和分享是十分重要的議題，本研究根據認知理論，調查知識貢獻者的分享動機，包括認知有用性、社群認同感、利他主義傾向、認知娛樂性和Web 2.0自我效能，以及Web 2.0選擇權對於分享意圖的調節效果。本研究對象來自於全球性樣本，經驗交流型平台蒐集了568位有效樣本；智慧累進型平台則有694位有效樣本。結果發現，Web 2.0選擇權會顯著地影響使用者的知識分享動機。對於經驗交流型平台而言，高度的知識與流程選擇權會顯著地調節知識貢獻者的社群認同感、利他主義傾向以及Web 2.0自我效能對於知識分享的意圖；對於智慧累進型平台而言，低度的知識與流程選擇權會顯著地調節知識貢獻者的社群認同感與認知有用性對於知識分享的意圖，而高度的流程選擇權則會調節貢獻者的認知娛樂性對於分享的意願。因此，組織在提供Web 2.0服務時，無論是為了人際交流目的或是知識累積目的，皆需要妥善地利用Web 2.0選擇權，才能有效建立良善的知識分享循環之平台。

關鍵詞：Web 2.0、知識分享流程、知識分享動機、數位選擇權。

## Abstract

Web 2.0 is the network on which individuals contribute to the development and distribution of content, tools, and software applications over the Internet. Due to the collaborative and interactive features of the platform, this user intention can be highly affected by the Web 2.0 options—i.e., the reach and richness of knowledge and processes enabled on the Web 2.0 platforms. Based on cognitive theories, this study examines the determinants of knowledge sharing and the moderating effects of Web 2.0 options on the sharing intention. Motivators such as perceived usefulness, community identification, altruism tendency, perceived enjoyment, and Web 2.0 self-efficacy were verified by frequent contributors of all types. A global sample from contributors of two major types of Web 2.0 platforms, experience-socialization platforms (N = 568) and intelligence-proliferation platforms (N = 694), were collected. The results confirm that user motivations to contribute are moderated by Web 2.0

options. For contributors to experience-socialization platforms high knowledge and process options can affect their sense of community identity, altruism tendency, and Web 2.0 self-efficacy towards sharing intention. For contributors of intelligence-proliferation platform, low knowledge and process options affect the user's sense of community identity and perceived usefulness that shapes their intention to share. By the same token, high process options affect contributors' feeling of joyfulness towards contributing on the platform. Organizations providing Web 2.0 services for either socialization purposes or knowledge retention purposes need to leverage Web 2.0 options properly in order to build effective platforms and nurture a strong, growing stream of knowledge contribution.

**Keywords:** Web 2.0, delurking, motivation, Web 2.0 options.

## 二、緣由與目的

Web 2.0 platforms create social networks that permit the exchange and retrieval of relevant knowledge on the Internet (Bauckhage, Alpcan, Agarwal, Metze, Wetzker, Ilic and Albayrak, 2007). With evolving Web 2.0 technologies, knowledge management is rapidly becoming a key issue in integration and collaboration for knowledge creation (Lee and Lan, 2007). These technologies have incorporated a two-way, interactive mechanism to provide services for enabling rich learning, knowledge creation, and collaboration environment (Lee and Lan, 2007). The success of this type of social network depends greatly on user-generated content (Jacobs, 2000) and the most critical factor for the success of any community is participants who make contributions to the content creation. Such active posters are the most valuable assets of the Web 2.0 community.

A study of visits to major web 2.0 websites (Tancer, 2008) has found that 90 percent of users in virtual communities are lurkers, who observe but do not contribute. Lurkers lurk for various reasons, including learning, enjoyment, and socialization. However, such participation is passive (Rafaeli, Ravid and Soroka, 2004). Delurking is thus a critical aspect of this collaborative knowledge creation platform. Since participation on Web 2.0 is voluntary and open, knowledge contribution in Web 2.0 formats should be based on a spontaneous motivation framework.

To encourage voluntary contribution to interactive platforms in Web 2.0, there is a strong need for an understanding of the determinants of knowledge contribution (delurking) on a Web 2.0 platform. Three questions are asked: What are the factors that affect knowledge sharing intention with Web 2.0? How do Web 2.0 options moderate the intention to keep sharing knowledge? What are different strategies for triggering the delurking process across the different types of Web 2.0 platforms? Previous studies have confirmed that motivation is essential for knowledge contribution (Constant, Sproull and Kiesler, 1996; Szulanski, 2000; Wasko and Faraj,

2005), because of the need for incentives to create bandwagon effects (Oliver, Marvell and Teixeira, 1985). Based on cognitive evaluation theory, this study plans to re-conceptualize extrinsic and intrinsic subsystems, regarding individual motivation, capability motivation, social influence motivation, and technology adoption motivation, to form propositions about continuous knowledge contribution in the Web 2.0 communities.

Previous studies on knowledge sharing of the social network research have focused primarily on the process of knowledge contribution in virtual communities (Constant *et al.*, 1996; Wasko and Faraj, 2005; Chiu, Hsu and Wang, 2006; Lin, 2007), and have been applied in explaining the knowledge sharing patterns in information and communication technology (ICT) enabled platforms. Little attention has been paid to how managers of electronic networks enhance user motivation to contribute knowledge through ICTs across different Web 2.0 communities. A Web 2.0 community is a self-organizing and open activity system with strong influences from the functions of the platform. Previous studies have indicated that the digital options (Sambamurthy, Bharadwaj and Grover, 2003), which refers to a set of IT-enabled capabilities, can cultivate the flexibility and agility of the services provided. The digital options of the Web 2.0 platforms may have a strong effect on the determination to engage in knowledge sharing. For example, data uploading functions can affect the efficiency of data sharing, data presentation can affect the absorption of the content, and the depth and timeliness of knowledge of the platform can affect the motivation to share. Therefore, the Web 2.0 option can be a key moderating factor for inducing individual motivation to engage in knowledge sharing. However, the impact of Web 2.0 options on resource exchange activities is still unclear.

The objectives of the study are to examine the factors involved in the delurking process and the impact of Web 2.0 options for the enablement of Web 2.0 services. A model of motivations for the delurking process is proposed and propositions are offered in following sections.

三、研究成果
**Research Model**

This study attempted to examine whether the effects of the aforementioned factors on intention to share continuously knowledge are different when users contribute through different types of Web 2.0 options. From the perspective of cognitive evaluation theory, extrinsic motivation, including perceived usefulness and community identification, and intrinsic motivation, including altruism tendency, perceived enjoyment, and Web 2.0 self-efficacy, were hypothetically taken as the

antecedents to intention to engage in knowledge sharing. The research model is shown in Figure 1.
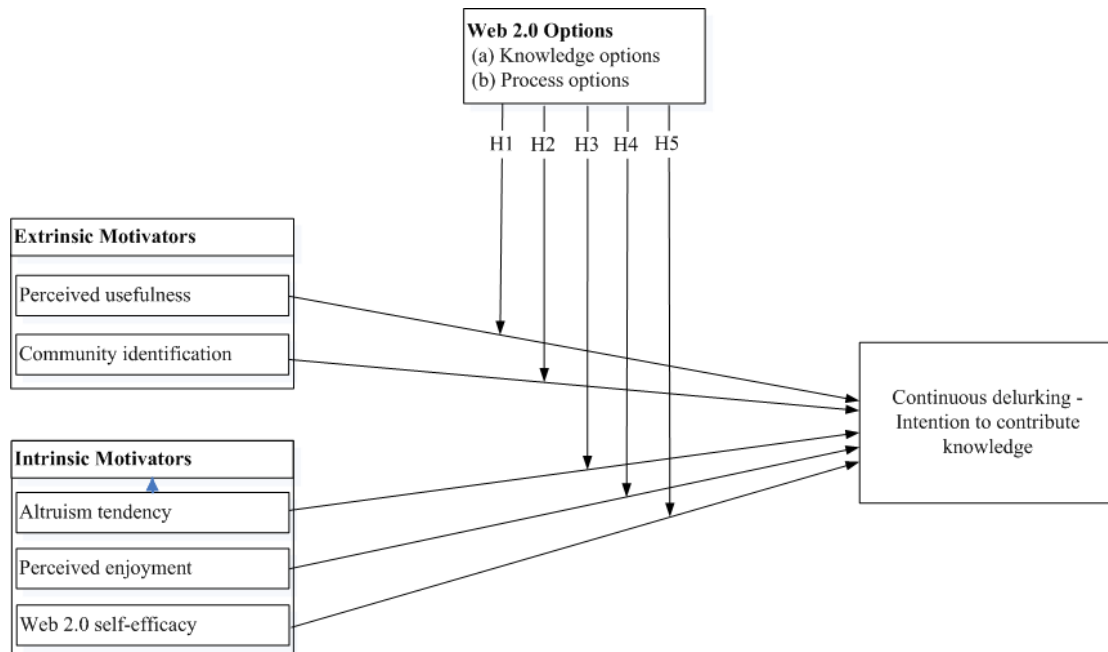


**Figure 1. Research Model**

## The Moderating Effects of Knowledge Options

In order to test the moderating effects of Web 2.0 options, the study divided the valid samples into the low knowledge option group (a total of 269 samples in experience-socialization platform and a total of 337 samples in intelligence-proliferation platform) and the high knowledge option group (a total of 299 samples in experience-socialization platform and a total of 357 samples in intelligence-proliferation platform) based on the median of knowledge option scores. Then, we tested separately the structural models of each group of two platforms.

*Experience-socialization platform.* The path coefficients, as shown in Table 1, revealed that three independent variables (i.e., perceived usefulness, perceived enjoyment, and Web 2.0 self-efficacy) had significant effects on contribution intention in the low knowledge option group. On the other hand, all five independent variables (i.e., perceived usefulness, community identification, altruism tendency, perceived enjoyment, and Web 2.0 self-efficacy) had a significant effect on contribution intention in the high knowledge option group. The results of the equality constraint model showed that knowledge options did not moderate the relationship between perceived usefulness and contribution intention, $\chi^2(df:1)=0.804$, $p>.1$, the relationship between perceived enjoyment and contribution intention, $\chi^2(df:1)=0.014$, $p>.1$, and the relationship between Web 2.0 self-efficacy and contribution intention,

$\chi^2$(df:1)=0.355, $p>.1$. However, knowledge options did moderate the relationship between community identification and contribution intention, $\chi^2$(df:1)=2.843, $p<.1$, and the relationship between altruism tendency and contribution intention, $\chi^2$(df:1)=3.176, $p<.1$.

**Table 1. The results of the moderating effects of knowledge options: Experience-socialization platform**

| Path | $\gamma$coefficient ($t$ value) | | Equality constraint model $\Delta\chi^2$($p$ value) |
| --- | --- | --- | --- |
| | Low knowledge options | High knowledge options | |
| PU→IN | 0.088 (1.951)** | 0.142 (3.640)*** | 0.804 (0.370) |
| CI→IN | 0.004 (0.113) | 0.103 (2.283)** | 2.843 (0.092)* |
| AT→IN | 0.006 (0.084) | 0.156 (2994)*** | 3.176 (0.075)* |
| PE→IN | 0.390 (6.949)*** | 0.401 (6.153)*** | 0.014 (0.905) |
| SE→IN | 0.095 (1.814)* | 0.140 (2.577)** | 0.355 (0.551) |

* p<.1;** p<.05;*** p<.01

Low knowledge option group: $\chi$2(df:130)=327.01 ; $\chi$2/df= 2.52; NFI=0.87; NNFI=0.90; GFI=0.88; CFI=0.92; IFI=0.92; RMSEA=0.07;

High knowledge option group: $\chi$2(df:130)=280.02 ; $\chi$2/df=2.15; NFI=0.89; NNFI=0.92; GFI=0.91; CFI=0.93; IFI=0.93; RMSEA=0.07;

*Intelligence-proliferation platform.* The results of the path coefficients, as shown in Table 2, revealed that four independent variables (i.e., perceived usefulness, community identification, altruism tendency, and perceived enjoyment) had significant effects on contribution intention in the low knowledge option group. On the other hand, only perceived usefulness, altruism tendency, and perceived enjoyment had significant effects on contribution intention in the high knowledge option group. The results of the equality constraint model showed that knowledge options did not moderate the relationship between perceived usefulness and contribution intention, $\chi^2$(df:1)=0.863, $p>.1$, the relationship between altruism tendency and contribution intention, $\chi^2$(df:1)=1.059, $p>.1$, the relationship between perceived enjoyment and contribution intention, $\chi^2$(df:1)=0.908, $p>.1$, and the relationship between Web 2.0 self-efficacy and contribution intention, $\chi^2$(df:1)=1.073, $p>.1$. However, knowledge options did moderate the relationship between community identification and contribution intention, $\chi^2$(df:1)=5.739, $p<.05$. Specifically, the effect of community identification on contribution intention was stronger for contributors in a low level of knowledge options than for contributors in high level of knowledge options.

**Table 2. The results of the moderating effects of knowledge options: Intelligence-proliferation platform**

| Path | γ coefficient ($t$ value) | | Equality constraint model $\Delta\chi^2$($p$ value) |
|---|---|---|---|
| | Low knowledge options | High knowledge options | |
| PU→IN | 0.141 (2.864)*** | 0.210 (3.762)*** | 0.863 (0.353) |
| CI→IN | 0.145 (3.050)*** | -0.008 (-0.187) | 5.739 (0.017)** |
| AT→IN | 0.403 (6.728)*** | 0.493 (7.658)*** | 1.059 (0.304) |
| PE→IN | 0.350 (6.714)*** | 0.422 (7.747)*** | 0.908 (0.341) |
| SE→IN | -0.043 (-0.918) | 0.020 (0.561) | 1.073 (0.300) |

* p<.1;** p<.05;*** p<.01

Low knowledge option group: $\chi$2(df:130)= 392.47; $\chi$2/df=3.02; NFI=0.88; NNFI=0.90; GFI=0.89; CFI=0.92; IFI=0.92; RMSEA=0.07;

High knowledge option group: $\chi$2(df:130)=426.55; $\chi$2/df=3.28; NFI=0.89; NNFI=0.90; GFI=0.88; CFI=0.92; IFI=0.92; RMSEA=0.08;

## The Moderating Effects of Process Options

Based on the median of process option scores, the study divided the valid samples into the low process option group (a total of 277 samples in experience-socialization platform and a total of 286 samples in intelligence-proliferation platform) and the high process option group (a total of 291 samples in experience-socialization platform and a total of 408 samples in intelligence-proliferation platform). Then, we tested separately the structural models of each group of two platforms.

*Experience-socialization platform.* The path coefficients, as shown in Table 3, revealed that only two independent variables (i.e., perceived usefulness and perceived enjoyment) had significant effects on contribution intention in the low process option group. On the other hand, all five independent variables had a significant effect on contribution intention in the high process option group. The results of the equality constraint model showed that process options did not moderate the relationship between perceived usefulness and contribution intention, $\chi^2$(df:1)=2.047, $p$>.1, the relationship between community identification and contribution intention, $\chi^2$(df:1)=0.177, $p$>.1, the relationship between altruism tendency and contribution intention, $\chi^2$(df:1)=0.780, $p$>.1, the relationship between perceived enjoyment and contribution intention, $\chi^2$(df:1)=1.741, $p$>.1. However, process options did moderate the relationship between Web 2.0 self-efficacy and contribution intention, $\chi^2$(df:1)=3.302, $p$<.1.

**Table 3. The results of the moderating effects of process options:**
**Experience-socialization platform**

| Path | $\gamma$coefficient ($t$ value) | | Equality constraint model $\Delta\chi^2$($p$ value) |
| --- | --- | --- | --- |
| | Low process options | High process options | |
| PU→IN | 0.070 (1.655)* | 0.155 (3.769)*** | 2.047 (0.153) |
| CI→IN | 0.050 (1.260) | 0.074 (1.718)* | 0.177 (0.674) |
| AT→IN | 0.033 (0.529) | 0.112 (1.711)* | 0.780 (0.377) |
| PE→IN | 0.331 (5.373)*** | 0.446 (7.310)*** | 1.741 (0.187) |
| SE→IN | 0.049 (0.947) | 0.189 (3.359)*** | 3.302 (0.069)* |

* p<.1;** p<.05;*** p<.01

Low process option group: $\chi$2(df:130)=297.07; $\chi$2/df=2.29; NFI=0.87; NNFI=0.91; GFI=0.89; CFI=0.92; IFI=0.92; RMSEA=0.07;

High process option group: $\chi$2(df:130)= 289.42; $\chi$2/df=2.23; NFI=0.88; NNFI=0.92; GFI=0.90; CFI=0.93; IFI=0.93; RMSEA =0.07;

*Intelligence-proliferation platform.* The results of the path coefficients, as shown in Table 4, revealed that four independent variables (i.e., perceived usefulness, community identification, altruism tendency, and perceived enjoyment) had significant effects on contribution intention in the low process option group. On the other hand, only perceived usefulness, altruism tendency, and perceived enjoyment had significant effects on contribution intention in the high process option group. The results of the equality constraint model showed that process options did not moderate the relationship between community identification and contribution intention, $\chi^2$(df:1)=2.006, $p>.1$, the relationship between altruism tendency and contribution intention, $\chi^2$(df:1)=0.256, $p>.1$, and the relationship between Web 2.0 self-efficacy and contribution intention, $\chi^2$(df:1)=0.111, $p>.1$. However, process options did moderate the relationship between perceived usefulness and contribution intention, $\chi^2$(df:1)=8.377, $p<.01$, and the relationship between perceived enjoyment and contribution intention, $\chi^2$(df:1)=5.732, $p<.05$. Specifically, the effects of perceived usefulness and community identification on contribution intention were stronger for contributors in a low level of process options than for contributors in high level of process options.

**Table 4. The results of the moderating effects of process options:**
**Intelligence-proliferation platform**

| Path | γcoefficient (*t* value) | | Equality constraint model $\Delta\chi^2$(*p* value) |
|---|---|---|---|
| | Low process options | High process options | |
| PU→IN | 0.299 (4.879)*** | 0.078 (1.711)* | 8.377 (0.004)*** |
| CI→IN | 0.137 (2.371)** | 0.040 (1.089) | 2.006 (0.157) |
| AT→IN | 0.418 (7.186)*** | 0.463 (6.952)*** | 0.256 (0.613) |
| PE→IN | 0.297 (5.143)*** | 0.483 (9.355)*** | 5.732 (0.017)** |
| SE→IN | -0.023 (-0.435) | -0.002 (-0.042) | 0.111 (0.739) |

* p<.1;** p<.05;*** p<.01

Low process option group: $\chi^2$(df:130)= 392.47; $\chi^2$/df=3.02; NFI=0.88; NNFI=0.90; GFI=0.89; CFI=0.92; IFI=0.92; RMSEA=0.07;

High process option group: $\chi^2$(df:130)=426.55; $\chi^2$/df=3.28; NFI=0.89; NNFI=0.90; GFI=0.88; CFI=0.92; IFI=0.92; RMSEA=0.08;

## Conclusion

To motivate a continuous knowledge-creation cycle, the results of collaborative efforts are distributed on these types of platforms. Therefore, user-generated content is vital, requiring different efforts from different types of Web 2.0 service providers. The study compare different incentive systems for participants to actively contribute to the above two broad types of platforms through SEM (Structural Equation Modeling) analysis.

The results of this study showed that, for the contributors of experience-socialization platforms, the relative importance of community identification, altruism tendency, and Web 2.0 self-efficacy in the prediction of intention varied when platforms possessed different levels of Web 2.0 options. The effect of community identification on contribution intention was stronger for contributors in a high level of knowledge options than for those in a low level of knowledge options. Thus, platform managers should increase the breadth of experience shared and create up-to-date and extensive topics about experience since more experience posters can create a group identity that induces others to share their experiences of similar interests and skills. Besides, the effect of altruism tendency on contribution intention was stronger for contributors in a high level of knowledge options than for those in a low level of knowledge options. Platform managers should create echoes of experience from the group because more experienced posters can attract people to respond to the topic they care about. Moreover, the effect of Web 2.0

self-efficacy on contribution intention was stronger for contributors in a high level of process options than for those in a low level of process options. Hence, platform managers should build more social relationships since a greater number of users can induce the confidence to use the Web 2.0 platform and reduce entry barriers. Accordingly, learning in this kind of platforms is not the key.

On the other hand, for the contributors of intelligence-proliferation platforms, the relative importance of perceived usefulness, community identification, and perceived enjoyment in the prediction of intention varied when platforms possessed different levels of Web 2.0 options. The effect of perceived usefulness on contribution intention was stronger for contributors in a low level of process options than for those in a high level of process options. Thus, platform managers should promote featured content or core content collaboration and filter user IDs due to free-riders. Besides, the effect of community identification on contribution intention was stronger for contributors in a low level of knowledge options than for those in a high level of knowledge options. Platform managers should establish more detailed categorization because users of the platforms have a specific knowledge base, and they became the participants who enhanced the depth of professional knowledge. Moreover, the effect of perceived enjoyment on contribution intention was stronger for contributors in a high level of process options than for those in a low level of process options. Hence, platform managers should attract more active participators since sharing related knowledge and solving challenging problems within a group of people who have the same interests and needs is fun. Consequently, learning in this type of platforms is self enhancement, and the ratio of lurkers to contributors is high.

The contributions of the study are as follows. First, the study reconceptualized the extrinsic and intrinsic motivation and the Web 2.0 options in order to apply them to a Web 2.0 community, and we will show that these motivators can be used to induce participant intention to share knowledge, and that the Web 2.0 options play the pivotal role of moderator in shaping their intentions. Second, to harness collective intelligence in different types of Web 2.0 businesses, participants will be contributors of experience-socialization and intelligence-proliferation platforms. Thus, the study will need to conduct a global sample collection in order to generalize the findings. Third, the study will be useful to understand how to strengthen participants' intention to share their knowledge and thus in developing management strategies for different Web 2.0 communities.

Although the outlook for Web 2.0 applications is promising, as reflected in the growing number of merger and acquisition cases involving Web 2.0 sites, the bottom-line impact of Web 2.0 on knowledge contribution is still an ongoing issue requiring further study.

## 四、計畫成果自評部份

This research has achieved the goal of understanding the moderating effect of Web 2.0 option. One paper regarding the digital option of the Web 2.0 has been presented in AMCIS 2010 Conference. A paper on the research result was submitted to the Information and Management Journal and is under second review.

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國科會補助專題研究計畫項下出席國際學術會議心得報告

| 計畫編號 | NSC 98-2410-H-004 -008 | | |
|---|---|---|---|
| 計畫名稱 | WEB 2.0 知識價值創造之研究 | | |
| 出國人員姓名 | 尚孝純 | 服務機關及職稱 | 國立政治大學資訊管理學系副教授 |
| 會議時間 | 99 年 8 月 12 日至 99 年 8 月 15 日 | 會議地點 | Lima, Peru |
| 會議名稱 | (中文) AMCIS 第十六屆美國資訊系統研討會 (英文)16th Americas Conference on Information Systems | | |
| 發表論文題目 | (中文)Web 2.0 服務發展之生命週期管理 (英文)The Management of Web 2.0 Services Development Life Cycle | | |

一、　　參加會議經過

This is the first time for the AMCIS to be held in Southern Americas. We flew to Peru through LA in the US. In the arrival night (08/11) we met scholars from different countries. The keynote speech was delivered on Aug. 12. It is about the management of information technology in Southern American countries. Then we presented papers and listened to different tracks of presentations between Aug. 13th and 15th. The highlight of the conference was a forum on the emerging technology discussed by both practitioners and academics. Cloud computing has become the focal point for many organizations and the management of various cloud services seems to be major challenge for CIOs and CEOs.

二、　　與會心得

Web 2.0 has its unique life cycle. Organizations applying Web 2.0 for business proliferation would need to pay specific attention to the development of user community and the management of organizational intellectual capital.

三、　　考察參觀活動 (無是項活動者略)

無

四、　　建議

For future conferences to be held in Taiwan, it is important to manage the following items:　1) web site introduction with clear schedule of all events, 2) facilities prepared in each session and each room, 3) coordination with all session chairs before the conference, 4) meeting arranged for different interest groups, and 5) introduction of the host country.

五、　　攜回資料名稱及內容

The proceeding of 16th Americas Conference on Information Systems

五、其他

# The Management of Web 2.0 Services Development Life Cycle

**Shari S.C. Shang**
National Chengchi University
shari_shang@yahoo.com

**Ya-Ling Wu**
National Chengchi University
joanne0914.wu@gmail.com

**Oliver C.L. Hou**
National Chengchi University
oliverhou@msn.com

**Chun-Cheng Lin**
National Chengchi University
j.c.lin_922@hotmail.com

## ABSTRACT

This study is motivated by the prospect of harvesting the collective intelligence of the Internet via Web 2.0 services and aims at building a comprehensive framework for the management of Web 2.0 services development. By reviewing specific features of Web 2.0 services, we identify the acquisition of co-creators and viewers as the most influential task of Web 2.0 service development. Based on two typical Web 2.0 cases—Facebook and Wikipedia—we distinguish four phases of co-creator and viewer development throughout the life cycle of Web 2.0 services. The four phases are: model establishment, innovation dispersion, community expansion, and service re-invention. The four phases of Web 2.0 service development life cycle is then validated by industry experts and enriched by the Web 2.0 service cases. It is hoped that the elaboration of the life cycle of Web 2.0 services development can provide strategic input into the management of Web 2.0 services.

### Keywords

Web 2.0, Web 2.0 service, Web 2.0 service life cycle.

## INTRODUCTION

The World Wide Web has been considered the new digital era that makes it possible to tap into mass collaboration on a greater scale than ever before, dramatically altering every aspect of modern life (Tapscott and Williams, 2006). Web 2.0 is the network as a platform on which everyone contributes to the development and diffusion of content, tools, or software applications, and Web 2.0 applications are those that make the most

of the intrinsic advantages of that platform (O'Reilly, 2007). With the advancement of Web 2.0 technology, service providers can leverage the collective intelligence through the Internet and build different service models to develop all kinds of social communities.

Existing studies have offered a broad range of research on the value of Web 2.0 services in specific fields. For example, Bonabeau (2009) pointed out that tools using collective intelligence can perform in decision making better than theorists can explain. Siddiqui (2009) stated the Web 2.0 platform can improve personal productivity and professional development for knowledge workers. However, research to date has not explained how the platform should be developed in order to grow and sustain the community. With the increasing adoption of Web 2.0 services by both enterprises and entrepreneurs in the business world there is an urgent need for a complete understanding of the development of Web 2.0 services throughout the life of knowledge sharing and collaboration.

Based on the number of one-time adopter of the innovation Rogers (2003) suggested a six-phase model of innovation development from recognition of a need or a problem, through research, development, and commercialization of an innovation, to diffusion and adoption of the innovation by users, and finally to its consequences. The model considers innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption (Rogers, 2003) such as the use of the laptop computer, the Xerox machine, or the mechanized harvester. The model does not consider, however, the continuity of the participation of both the content providers and the content viewers with respect to the innovative technology.

Motivated by the prospect of harvesting the collective intelligence of the Internet via Web 2.0 services, this study constructs a comprehensive framework for the management of Web 2.0 services development. The objective of the study is to identify the Web 2.0 services development phases and elaborate each phase, including the challenges of each phase, in developing the collaborative contents. We first review the definition of Web 2.0 services as well as the characteristics and challenges of Web 2.0 services development, and then we identify the critical factors of Web 2.0 services. By examining typical Web 2.0 services, we identify the phases of Web 2.0 service life, then we discuss the typical Web 2.0 cases with two industrial experts to enhance understanding of service development during each phase in the Web 2.0 service Life. Therefore, our Web 2.0 service development model is expected to be used as an analytic tool and management guideline for Web 2.0 services managers when planning and operating Web 2.0 services.

**Literature review**

## Web 2.0 and Web 2.0 service

O'Reilly (2005) coined the term "Web 2.0," and many studies refer his viewpoint. Basically, Web 2.0 represents an era of the Web that began after the year of 2001, evolving from Web 1.0. At the same time, it also can be a collection of design patterns and business models of the Web sites thriving and robust in the era. Principally, it is about how the new Web works as the network on which Web users contribute to the development and distribution of tools, contents, and software applications over the Internet (Shang, Wu and Hou, 2009).

Web 2.0 provides a nutritional space-time environment for the new service, called Web 2.0 service. In O'Reilly's (2007) viewpoint, the nature of the service is software, but the Web 2.0 service is different from the traditional software because of user participation. From the viewpoint of the service user, "whether people are creating, sharing, or socializing, the new Web is principally about participating rather than about passively receiving information" (Tapscott and Williams, 2006, p. 37). The people who use the Web 2.0 service virtually form a community, and the community contributes to the development of the service in many ways and makes the service better. The participants could be the content providers or the interface generators. They participate in the service development when they use the service. The community is part of the service, and the service users are the co-creators of the service. Famous Web 2.0 services include Wikipedia, Facebook, YouTube, and Flickr, and all of these services have vibrant communities.

Based on the above definitions, the study considers the Web 2.0 service to be the service delivered with user participation and collaboration on the Internet. There is architecture of participation embedded in the service model of the Web site, and it causes the Web 2.0 service to get better as more people use it. This architecture enables the service users to feed the Web site with their effort at the same time they are using the service. The service users can participate in the development of the Web 2.0 service in many ways. In addition to providing content for the Web site, they can organize the information on the site, generate the site interface for themselves and other service users, or even keep the order of the virtual community. All of these participations can make the service better and better over time.

## Characteristics and challenges of Web 2.0 service development

Carr (2008) mentioned numerous characteristics of Web 2.0 service development in his book. First, the special construction of the manpower greatly reduces costs but speeds up the service development. According to the concept of the "gift economy" used by Carr (2008), user-generated content is the gift, the service platform is the gift

receiver, and sharing, rather than selling in the market economy, is the economic driver. Second, besides the manpower factor, the hardware resource needed to develop the service is processing power, storage capacity, and communication bandwidth, and these are relatively cheaper than the expensive equipment and laboratories required for other technology innovations. Third, the price of creating a fresh copy and distributing the service to a new customer anywhere is essentially zero due to the digital nature of the content. Fourth, the effect of business scale is positive relative to the service quality because of the network effect that the service quality is more valuable as more people use it, while the quality remains consistent in other technology innovations. Finally, these characteristics make the effect of business scale on profits an increasing one because returns keep growing as use expands without limit, while there is a diminishing return to business scale in other technology environments, which limits the size of profits. Based on the above points, most of these characteristics come from the participation of the service users.

The development process of the Web 2.0 service has two common challenges. The first is the cold-start problem as the typical challenge (Perugini, Goncalves and Fox, 2004; Hummel, Burgos, Tattersall, Brouns, Kurvers and Koper, 2005; Julita and Lingling, 2007). This is like a chicken-and-egg problem. The Web 2.0 service heavily relies on external people to co-develop it, and a vibrant community can attract external people to join it, but a useful and interesting community has to exist first. The cold-start problem is also referred as the day-one or early rater problem, which means that few people, uses the service in the early days of the service development. Although the users of Web 2.0 services participate in the service development, they do not appear at the same time—some they join the development in the early stage, and some come in afterward.

Second, Nielsen (2006) reveals the phenomenon of participation inequality, and this introduces another problem called the de-lurk problem. The service user can be divided into two masses, one called "contributors," who upload videos or photos or post an article, and the other called "lurkers," who just surf and read the page without uploading anything. There is a participation inequality because most of the content is provided by the contributors (Nielsen, 2006; Tancer, 2008). In order to acquire more contributors, there needs to be a way of either getting outside users to use the service, similar to cold-start, or encouraging the inside lurkers to contribute something, called "de-lurking." Osimo (2008) further points out the various forms of participation based on the functional complexity, and the service users can be further divided into several groups, including content producers, content raters, content reviewers, and so on. It seems that the functional complexity is negative to the size of the user group and suggests that the service should be easy to use to help create de-lurking. Therefore,

the service users not only participate in the service development at different times but also participate in the different forms and therefore provide different types of contributions.

What we learn from the above literature is that the service funder should invite the service users to be the co-creators of the service, contributing their effort in various forms besides just reading the page, and encourage them to participate in the service development more frequently so as to be active users, who continuously contribute their effort. After that, the service users look like employees working for the development of the service at the same time that they use the service.

With these types of free labor, the service funder has little cost to achieve a large business. Broadly speaking, both co-creators and viewers are the co-developers of Web 2.0 services via well-designed participation architecture, which is embedded in the service model. Even viewers who only surf and seem not to provide anything for the service actually contribute something in the background. For example, they can feed the service with their clicks before they read the page, and the service automatically accumulates these clicks to reveal the most popular content. This can drive the co-creators to provide similar content to earn the "popularity of eyeball," give the service funders some directions when they need to adjust the service model, and eventually indirectly sustains the Web 2.0 services. When we manage Web 2.0 services, besides the indicators of co-creators and viewers, we should consider the third indicator, which is the contribution ratio, or the percentage of viewers who are also co-creators. This helps to evaluate the effect and cost when the service managers need to design incentive mechanisms for the two types of target users.

**Research Methodology**

The research process of this study is displayed in Table 1. First, in order to explore the Web 2.0 service-development life cycle, the study paid particular attention to reviewing related literature regarding the critical features of Web 2.0 service development. Second, we analyzed two typical Web 2.0 services, Facebook and Wikipedia, to identify different phases of the Web 2.0 service development life cycle. These two cases were selected for the following reasons. (1) Grossman (2006) in Time Magazine selected Facebook and Wikipedia as two typical examples of all Web 2.0 services (2) Various Internet marketing metrics reported by several Internet marketing research companies, including Alexa (2010), Nielsen NetView (2010), Compete (2010), Quantcast (2010), Hitwise (2010), Ranking.com (2010), and comScore Media Metric (2009), showed that Facebook and Wikipedia are the top two Web 2.0 sites according to the traffic ranking, both in the American market and the

global market. (3) Both of these cases have related statistics and rich information about the service development, and they publish it on their official Web sites (Facebook, 2009; Wikipedia, 2009) for querying.

| Steps | Why | How | Results |
|---|---|---|---|
| 1. Literature Review | To find specific features of Web 2.0 services | Literature reading and consolidation | The criticality of co-creator and viewers in sustaining Web 2.0 services |
| 2. Content Analysis | To identify the life cycle of various Web 2.0 services | Two typical cases, review and consolidation | Proposed four-phase life cycle of Web 2.0 services development |
| 3. Expert Interviews | To understand why and how the co-creators and viewers grow or decrease in each phase; | Interview two industry experts | Verified findings |
| 4. Conclusion | To organize findings and draw conclusion | Consolidate verified findings, industry knowledge, and relevant literature | Findings and implications |

**Table 1. Research Process**

In addition, to understand deeply the problem of participation inequality, the study collected data from multiple sources—journals, books, official Web sites, and secondary sources (e.g., reported cases by several Internet marketing research companies)—and adopted three critical indicators—co-creators, viewers, and contribution ratio—to analyze Web 2.0 service devolvement. This study adopts contribution ratio as the key factor to indentify and analyze the Web 2.0 service development because the construction of a Web 2.0 website depends mainly on co-creators to contribute while the services grow along with a critical mass of viewers. The continuity of the services is therefore based on a stable flow of participation from both co-creators and viewers. First, total page view is the most popular indicator to judge the success of a site (Cassidy, 2006; May and Kwong, 2007), and we use Alexa's Reach data (Alexa, 2010; Wikipedia, 2010a) as the viewer indicator.

Co-creators is selected by the study as the second indicator because the success of Web 2.0 depends upon user-generated content. Regarding the number of Facebook's and Wikipedia's co-creators, we adopted separately the "active user" data from Facebook's (2009) and Wikipedia's (2009) official Web sites to observe longitudinally service development of the two services. The observation period for Facebook is from October 2003 to December 2009, and the period for Wikipedia is from March 2000 to December 2009. Moreover, we plot a scatter diagram of Facebook to portray the patterns of co-creator and viewer, and then we calculate contribution ratio, the formula which is "active user number / viewer number," in different phases of service development. After analyzing patterns of contribution ratio, two industry experts are interviewed for getting a richer understanding of the challenges of each phase of Web 2.0 service development. They are the managers of an e-commerce company, and they have more than four years of managerial experience with Web 2.0 applications. The experts analyzed the market condition and provided industry knowledge based on the preliminary verified findings. Finally, the study draws a conclusion based on these verified and validated results, and research results from these data are discussed below.

**Four phases of Web 2.0 service development with content analysis**

The purpose of this study is to identify the four phases of the life cycles of various Web 2.0 services and explore longitudinal activities in the service development processes of successful Web 2.0 cases, Facebook and Wikipedia, for providing Web 2.0 service managers some management decision-making guidelines. We judge each changing point by the change of the slope in different phases of the contribution ratio. In phase I, the slope of contribution ratio shows a rapid decline; the slop in phase II is more flattened than in phase I; the slop in phase III is dynamic change, including up and down; and the slop of the last phase is very flattened and stable, as discussed below.
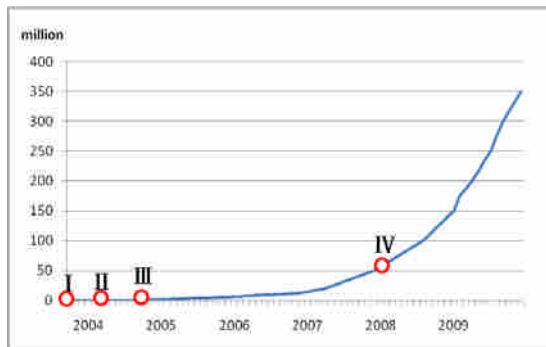
## Facebook

Facebook is a social networking Web site that has been operating since February 4, 2004 and is privately owned by Facebook, Inc. Anyone over the age of 13 with a valid e-mail address can become a Facebook user. Users can add friends and send them messages, and update their personal profiles to notify friends about themselves. A January 2010 Compete.com study ranked Facebook as the most used social network by worldwide monthly active users. To observe longitudinally service development of Facebook, the study used the data of "active user," defined as those who have returned to the site in the last 30 days (Facebook, 2010), from Facebook (2009) and

the data on viewers from Alexa's Reach data (Alexa, 2010). In addition, we plotted a scatter diagram of Facebook to portray the patterns of co-creator, viewer, and contribution ratio, all of which are shown in Figure 1. The following is a discussion of why and how the co-creators and viewers grow in each changing point, as summarized in Table 2.
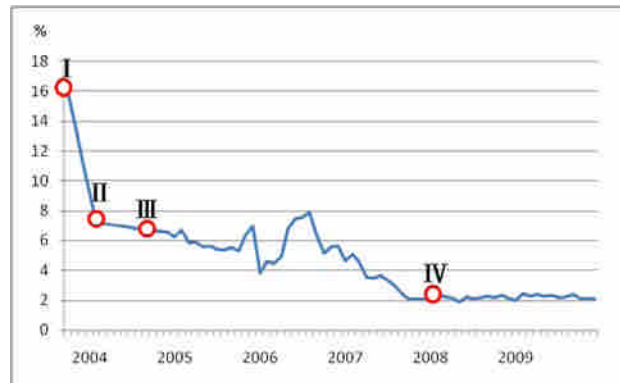


(a) Contribution ratio (active user / viewer) pattern



(b) Active user pattern
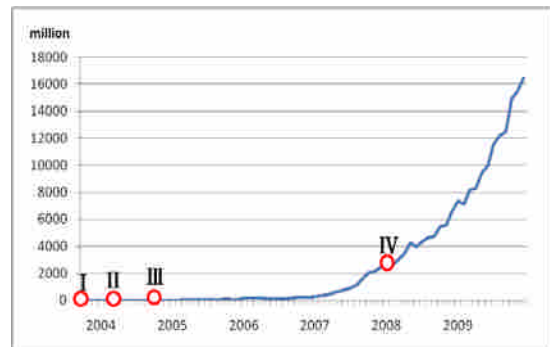
(c) Viewer pattern

Figure 1. The Patterns of Service Contributors, Viewers, and Contribution Ratio on Facebook

*Changing Point I*

On October 28, 2003, Mark Zuckerberg invented Facemash when attending Harvard as a sophomore. Based on the Harvard Crimson (Tabak, 2004), Facemash represented a Harvard University version of Hot or Not to improve poor content, and it used photos compiled for placing two next to each other at a time and asking users to choose the "hotter" person. The number of active users and viewers in this period grew, but very slowly. The initial site generated 450 visitors and 22,000 photo-views in its first four hours online (Locke, 2007), and that mirrored people's physical community with their real identities. To accomplish this, Facemash had to become an open investment in order to expand its resources in hardware and bandwidth.

*Changing Point II*

On February 4, 2004, Zuckerberg launched Facebook with his college roommates and fellow computer science students Eduardo Saverin, Dustin Moskovitz, and Chris Hughes from their Harvard dorm room. With the expansion of the user scale, the growth of active users and viewers was increasing gradually, but contribution ratio was decreasing because the Web site's membership was limited by the founders to Harvard students for the first two months. After that, it was quickly expanded to other colleges in the Boston area, the Ivy League, and Stanford University so that the site faced a capital shortage problem. Facebook incorporated in the summer of 2004, and Facebook received its first investment of US$500,000 in June 2004 from PayPal co-founder Peter Thiel. At the same time, Facebook moved its base of operations to Palo Alto, California.

Users can create profiles with photos, lists of personal interests, contact information, and other personal information. Communicating with friends and other users can be done through private or public messages or a chat feature. However, the big problem here is that a data collection company can end up being lifelong "friends" with millions of individuals. In order to deal with privacy concerns, Facebook designed privacy settings to enable their users to control how they share their information on Facebook, because many users were not willing to permit the application to have access to all kinds of data from their profile.

*Changing Point III*

In September 2004, the Groups application was added, and the Wall was added as a profile feature. Users can create and join interest and fan groups, some of which are maintained by organizations as a means of advertising. It later expanded further to include potentially any university student, then high school students, so that the growth of active users and viewers increased more quickly. With overloading and downtime increasing, Facebook received funds of USD$12.7 million in venture capital from Accel Partners for growth to support more than 800 college networks in April 2005, and then USD$27.5 million more from Greylock Partners. The site also announced a high school version in September 2, 2005 to attract more active users. At that time, high school networks required an invitation to join. Facebook later expanded membership eligibility to employees of several companies, including Apple Inc. and Microsoft. The company dropped "The" from its name after purchasing the domain name facebook.com in 2005 for $200,000. Then, however, a cash flow statement showed that during the 2005 fiscal year Facebook had a net loss of $3.63 million. Facebook was then opened in September 26, 2006 to everyone aged 13 and older with a valid e-mail address; however, it is difficult to prevent children's usage on Facebook. In November 2006, the share feature was added and Facebook

was simultaneously launched on over 20 partner sites. Therefore, the site during this period expanded the number of its co-creators and reviewers rapidly.

*Changing Point IV*

In November 2007, Facebook announced Facebook Beacon, which was a part of Facebook's advertisement system that sent data from external Web sites to Facebook for the purpose of allowing targeted advertisements and allowing users to share their activities with their friends. After Facebook was criticized for collecting more user information for advertisers than was previously stated, Zuckerberg publicly apologized on December 5, 2007 for the way Facebook launched Beacon. During this period, it has been banned at many places of work to discourage employees from wasting time using the service and blocked intermittently in several countries including Syria, China, Vietnam, and Iran, due to privacy and other issues. For example, it is illegal to go onto Facebook in China. The government has blocked it because it is a form of freedom restricted by the government. Thus, Facebook began to adjust its privacy police and succeeded in giving people control over what and how they share information. All users could then feel confident in contributing their experience, and the contribution ratio appeared to have flattened out from 2008 to 2009. Besides advertising, Facebook cooperated with Apple iTune for music downloading to gain more revenue.

| Facebook | Stage I: Model establishment | Stage II: Innovation dispersion | Stage III: Community expansion | Stage IV: Service re-invention |
|---|---|---|---|---|
| **Period** | 2003.10 – 2004.02 (4 months) | 2004.02–2004.08 (7 month) | 2004.09 – 2007.10 (38 months) | 2007.11 – Now (28 months) |
| **Challenge** | The main theme and quality of content provided | • Capital shortage<br>• Privacy problem | • Overloading and increasing downtime<br>• Usage limitation for different age group | • Acquiring new and retain old participants<br>• Revenue growth<br>• Access restriction<br>• Hackers<br>• Growing user demands |
| **Revenue source** | Support from Harvard | Angel Investors | Venture capital | • Advertising<br>• Cooperation with different enterprises |

Table 2. Facebook's Service Development

Next, Facebook initiated the Open Stream Application Programming Interface (API) service for third parties to develop applications that can execute on the Facebook platform. These APIs attract considerable numbers of users and encourage users to spend more time on the site. The famous application "Happy Farm" was developed

based on this mechanism. However, the users have pointed out that they sometimes get tired of all the quizzes and application notifications showing up on their news feed. Facebook then designed the "Block BF Quizzes" application to auto-block the applications of the update. Next, Facebook announced the German, French, Spanish, and Chinese (for areas outside the PRC) versions in 2008 to attract more active users. The Web site currently has more than 400 million active users worldwide. With the expansion of the scale, the users have more and more complaints about the limitation of maximum number of friends who can be invited, which is currently 5,000. In August 2009, Facebook announced the rollout of a "lite" version of the site, optimized for users on slower or intermittent Internet connections. Facebook Lite offered fewer services, excluded most third-party applications, and required less bandwidth. A beta version of the slimmed-down interface was released first to invited testers, before a broader rollout across users in the USA, Canada, and India. This version is especially designed for mobile service, with a smaller screen size and limited bandwidth. In September 2009, Facebook claimed that it had turned cash flow positive for the first time. At that time, Facebook also announced that it would shut down the Beacon service.
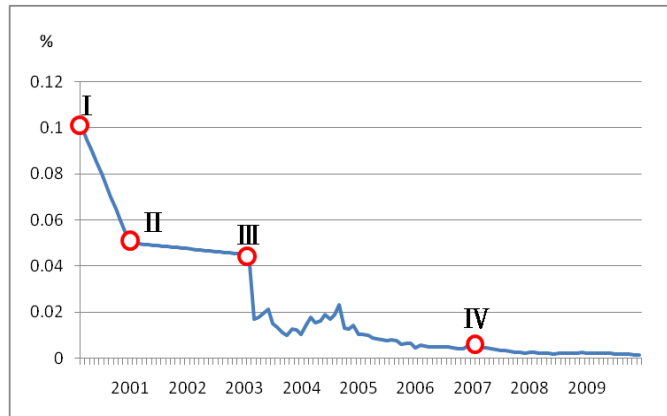
## Wikipedia

Wikipedia is a free, Web-based, collaborative, multilingual encyclopedia project supported by the non-profit Wikimedia Foundation. Its name is a combination of Wiki (a technology of creating collaborative Web sites, from the Hawaiian word meaning "quick") and Encyclopedia. It was launched in 2001 by Jimmy Wales and Larry Sanger. To observe longitudinally the service development of Wikipedia, the study used the data of "active user," which contributes at least five times each month (Wikipedia, 2010b), from Wikipedia (2009), and the data on viewers from Alexa's Reach data (Alexa, 2010; Wikipedia, 2010a). In addition, we plotted a scatter diagram of Wikipedia to portray the patterns of co-creator, viewer, and contribution ratio, all of which are shown in Figure 2. The following is a discussion of why and how the co-creators and viewers grow in each changing point, as summarized in Table 3.
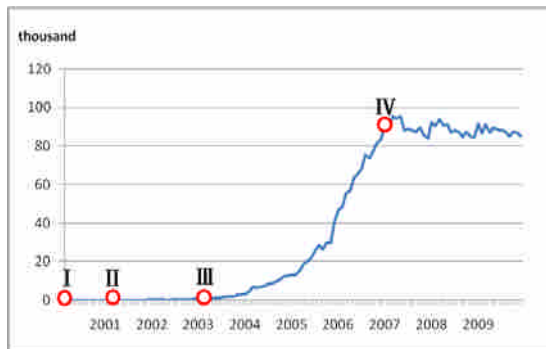
### *Changing Point I*

Wikipedia comes from an English–based, free online encyclopedia project called Nupedia, which was founded on March 9, 2000, under the ownership of Bomis, Inc., a Web portal company (Lih, 2009). Articles in Nupedia were written by experts and reviewed under a formal process, so that the growth of active users and viewers was very slow. To solve the content problem, Jimmy Wales and Larry Sanger decided to make a publicly editable encyclopedia and launched it on January 15, 2001 to enrich the content and try to attract more viewers. Nupedia and Wikipedia coexisted until the
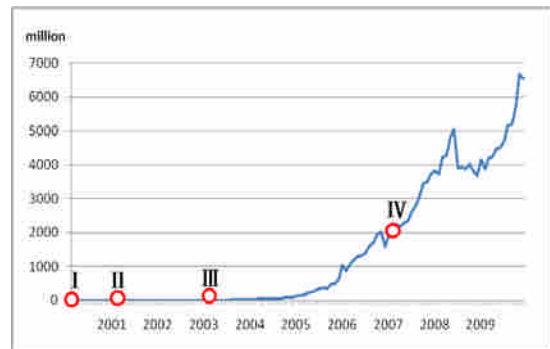
former's servers were taken down permanently in 2003, and its text was incorporated into Wikipedia.



(a) Contribution ratio (Active user / Viewer) pattern



(b) Active user pattern                    (c) Viewer pattern

Figure 2. The Patterns of Service Contributors, Viewers, and Contribution Ratio on Wikipedia

*Changing Point II*

After Wikipedia went alive in Wikipedia.com in January 2001, it gained early contributors from Nupedia. In order to attract more editors and viewers, Wikipedia set up an external cooperation relationship to attract new participants after being mentioned on Slashdot as well as in an article on the community-edited Web site Kuro5hin. During this period, it grew to approximately 20,000 articles and 18 language editions by the end of 2001. By late 2002, it had reached 26 language editions, 46 by the end of 2003, and 161 by the final days of 2004. With the expansion of the scale, the site also faced a capital shortage problem in this period.

*Changing Point III*

In early 2003, Wikipedia planned to open investment policies, and the creation of the Wikimedia Foundation was officially announced by Wikipedia co-founder Jimmy Wales on June 20, 2003. The Foundation's board can define "community" as it sees fit. Thus, Wikipedia began to promote the Wikipedia Chapters country-specific

nonprofits, which wield power far greater than their actual numbers would seem to warrant, and this mechanism can group to attract more people to participate in the development of the site. The number of Wikipedia contributors and articles were increasing dramatically during this period. Along with the fast growth of contributors, we found that there were more and more articles or figures captured from other publications without the original authors' authorization. This can cause copyright disputes and raise many arguments. In order mitigate the contention, Wikipedia now applies a review and delete mechanism to request contributors to cite the data or figure source. Reviewers are assigned the right to delete articles or figures without proper citation. Furthermore, Wikipedia also requests that contributors add links to material on an external site and ensure that the external site is not in violation of the creator's copyright. In order to block persistent violators from editing, English Wikipedia established, on December 4, 2003, an Arbitration Committee that consists of a panel of editors to impose binding rulings with regard to disputes between other editors of the online encyclopedia.

The open nature of the editing model also produced other criticisms of Wikipedia. For example, a reader cannot be sure whether or not an article has been vandalized with the insertion of false information or the removal of essential information. Wikipedia is defended from attack by many technical methods, including automatic detection mechanisms, computer programs that are carefully designed to try to detect attacks and fix them automatically (or semi-automatically), blocks on the creation of links to particular Web sites, and blocks on edits from particular accounts, IP addresses, and address ranges. For a manual mechanism, particular articles that are heavily attacked can be semi-protected so that only well-established accounts can edit them, or locked so that only administrators are able to make changes.

*Changing Point IV*

In this period, the growth of active users started to have a downward trend, and the viewer numbers increased continuously, so the contribution ratio was on the downside. Two reasons have been given: editors leaving and the boycotts by some countries. First, editor resistance from the Wikipedia community to new content, especially when the edits come from occasional editors, represented a growing contribution inequality as contributions became more biased toward a core of very active editors. In addition, the number of lost editors seems continuously increasing as time goes by. In November 2009, a Ph.D. thesis written by Felipe Ortega, a researcher at the University Rey Juan Carlos in Madrid, found that the English Wikipedia had lost 49,000 editors during the first three months of 2009; in comparison, the project lost only 4,900 editors in 2008.

Meanwhile, several sub-associations under Wikipedia have been established, such as the Wikimedia chapters and local associations of Wikipedia users, which participate in the promotion, development, and funding of the project, and some Wikipedia committees, such as the Arbitration Committee and the Mediation Committee. For example, the role of the Mediation Committee is explicitly to try to resolve disputes, especially those involving content, to the mutual satisfaction of all.

In addition, as the number of articles has increased, there are now materials that some people may find objectionable, offensive, or even pornographic. In 2008, Wikipedia rejected an online petition against the inclusion of depictions of Muhammad in its English edition. The presence of politically sensitive materials in Wikipedia had also led the People's Republic of China to block access to parts of the site. In order to recruit more members and attract more passion, Wikipedia will have to figure out these issues.

| Wikipedia | Stage I: Model establishment | Stage II: Innovation dispersion | Stage III: Community expansion | Stage IV: Service re-invention |
|---|---|---|---|---|
| Period | 2000.03 – 2000.12 (10 months) | 2001.01 – 2003.05 (29 months) | 2003.06 – 2006.12 (43 months) | 2007.01 – Now (38 months) |
| Challenge | • Poor content<br>• Cold-start problem | • Capital shortage<br>• De-lurking problem | • Content credibility<br>• Copy Right Issue | • Editors turnover<br>• Acquiring new and retain old participants<br>• Blocked by some countries for special event |
| Revenue source | Financial support from Bomis, Inc. | Financial support from Bomis, Inc. | Donations from Individuals | • Donation and gifts from Individuals, firms and foundations<br>• Business activities |

Table 3. Wikipedia's Service Development

**Life cycle of Web 2.0 service development with expert interview**

Through the above case analyses, the study found that there are four phases in the life cycle of Web 2.0 service development in both Wikipedia and Facebook. This study further interviewed two industrial experts and proposed the Web 2.0 service development model based on the status of co-creators and viewers of Web 2.0 services, shown in Figure 3 and discussed below.

The first phase is named "Model Establishment," which is focused on discovering the potential needs of the Web 2.0 service co-creators and building the service model to satisfy the needs recognized. In this initial phase, the number of Web 2.0 service co-creators is fewer and increases very slowly so that these sites usually often have to face the challenge of poor content. Thus, the service providers would need to spend more time in encouraging user participation activities for rich content and attracting more viewers.

The second phase is "Innovation Dispersion," which involves facing a growing need for the services, so that the service provider is adjusting the service features according to participants' needs. In this development phase, the number of Web 2.0 service co-creators is increasing more quickly than in the previous phase, and the viewers are growing at the same rate. According to the two cases, this phase often faces a capital shortage, which forces the service providers to explore open investment policies in order to build solid and continuously changing services.

The third phase is called "Community Expansion," whose challenge is to build its community scale through speeding the Web 2.0 service diffusion. The characteristic of this phase is the rapid growth of the service co-creators. However, sites in this phase often have to face many problems derived from deficient control mechanisms. In the two cases studied here, the service providers endeavored to establish appropriate virtual disciplines to provide stable and reliable services.

The fourth phase is "Service Re-invention," which consists of facing the challenge of continually re-inventing new service value to retain and grow the community. The characteristics of this phase are the stable number of the community scale and the mature service development stage. The sites in this phase often have to face problems about decreasing passion from co-creators. Thus, the service providers need to create new service values or models continuously to generate new and expanded community.
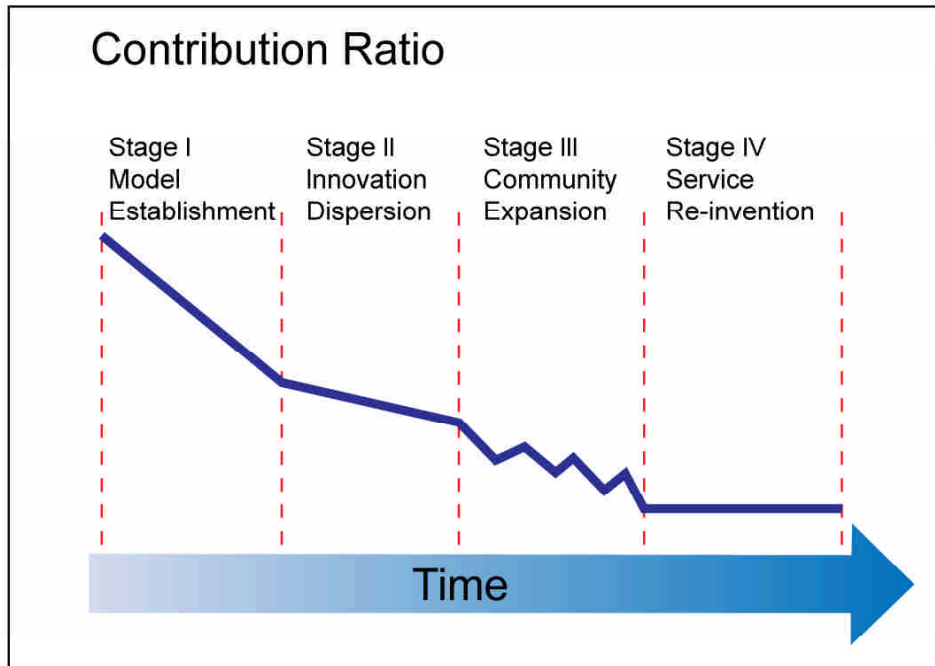
Figure 3. The Web 2.0 Service Development Model

**Conclusion**

In exploring the Web 2.0 services, this study first reviewed related literatures regarding critical features of Web 2.0 service development, and then we identified a four-phase life cycle of Web 2.0 service development through analyzing two typical cases, Facebook and Wikipedia. After expert interviews, we proposed the four phases of the Web 2.0 service development model, including model establishment, innovation dispersion, community expansion, and service re-invention, and these phases are a cyclic lifecycle. It starts from the model establishment phase, through innovation dispersion and community expansion, to the service re-invention phase, and then after the mature phase the service may begin another community-expansion phase with new increments of co-creator numbers.

There are two aspects of implications in this study. For academics, the study provides the systematic overview and comprehensive understanding of Web 2.0 service development for future researches regarding innovation development. For practical management, the study suggests that the viewer indicator, the active user indicator, and the contribution ratio can be viewed as measurement indicators for the management of Web 2.0 platforms. The platform managers can observe the pattern of contribution ratio to judge which phase they are in, and then they can further pay attention to prevent basic "4C" challenges—content, capital, control, and co-creators—which exist separately in all four phases. It is hoped that the elaboration

of the life cycle of Web 2.0 service development can provide strategic input into the management of Web 2.0 services.

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# 98 年度專題研究計畫研究成果彙整表

計畫主持人：尚孝純　　　計畫編號：98-2410-H-004-008-

計畫名稱：WEB 2.0 知識價值創造之研究

| 成果項目 | | | 量化 | | | 單位 | 備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等） |
|---|---|---|---|---|---|---|---|
| | | | 實際已達成數（被接受或已發表） | 預期總達成數(含實際已達成數) | 本計畫實際貢獻百分比 | | |
| 國內 | 論文著作 | 期刊論文 | 0 | 0 | 100% | 篇 | |
| | | 研究報告/技術報告 | 0 | 0 | 100% | | |
| | | 研討會論文 | 0 | 0 | 20% | | |
| | | 專書 | 0 | 0 | 100% | | |
| | 專利 | 申請中件數 | 0 | 0 | 100% | 件 | |
| | | 已獲得件數 | 0 | 0 | 100% | | |
| | 技術移轉 | 件數 | 0 | 0 | 100% | 件 | |
| | | 權利金 | 0 | 0 | 100% | 千元 | |
| | 參與計畫人力（本國籍） | 碩士生 | 0 | 0 | 100% | 人次 | |
| | | 博士生 | 0 | 0 | 100% | | |
| | | 博士後研究員 | 0 | 0 | 100% | | |
| | | 專任助理 | 0 | 0 | 100% | | |
| 國外 | 論文著作 | 期刊論文 | 0 | 1 | 40% | 篇 | Submitted to Information &amp; management second review |
| | | 研究報告/技術報告 | 0 | 0 | 100% | | |
| | | 研討會論文 | 1 | 0 | 20% | | Shari S. C. Shang and Ya-Ling Wu (2009) Moderating Effects of Web 2.0 Options on the Delurking Process, Proceedings of the Americas Conference on Information Systems (AMCIS 2009), August 6 - 9, San Francisco, California. |
| | | 專書 | 0 | 0 | 100% | 章/本 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 專利 | 申請中件數 | 0 | 0 | 100% | 件 | |
| | | 已獲得件數 | 0 | 0 | 100% | | |
| | 技術移轉 | 件數 | 0 | 0 | 100% | 件 | |
| | | 權利金 | 0 | 0 | 100% | 千元 | |
| | 參與計畫人力<br>（外國籍） | 碩士生 | 0 | 0 | 100% | 人次 | |
| | | 博士生 | 0 | 0 | 100% | | |
| | | 博士後研究員 | 0 | 0 | 100% | | |
| | | 專任助理 | 0 | 0 | 100% | | |

| | |
|---|---|
| 其他成果<br>(無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。) | 無 |

| | 成果項目 | 量化 | 名稱或內容性質簡述 |
|---|---|---|---|
| 科教處計畫加填項目 | 測驗工具(含質性與量性) | 0 | |
| | 課程/模組 | 0 | |
| | 電腦及網路系統或工具 | 0 | |
| | 教材 | 0 | |
| | 舉辦之活動/競賽 | 0 | |
| | 研討會/工作坊 | 0 | |
| | 電子報、網站 | 0 | |
| | 計畫成果推廣之參與（閱聽）人數 | 0 | |

# 國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

| |
|---|
| 1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估<br>■達成目標<br>□未達成目標（請說明，以 100 字為限）<br>　　　□實驗失敗<br>　　　□因故實驗中斷<br>　　　□其他原因<br>　說明： |
| 2. 研究成果在學術期刊發表或申請專利等情形：<br>論文：□已發表 □未發表之文稿 ■撰寫中 □無<br>專利：□已獲得 □申請中 ■無<br>技轉：□已技轉 □洽談中 ■無<br>其他：（以 100 字為限） |
| 3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）<br><br>First, the examination of Web 2.0 applications has facilitated the realization of the whole knowledge-creating cycle, from socialization and externalization through combination to internalization. Second, the study classified Web 2.0 platforms and proposed different management capabilities required for different kinds of knowledge-creating purposes. Third, the study proposes the concept of Web 2.0 options in order to examine their impact on user contribution behavior which is useful for further studies of Web 2.0 platforms management. |