

行政院國家科學委員會專題研究計畫 成果報告

以資訊不對稱理論建構升級意圖與前因變項 研究成果報告(精簡版)

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中華民國 100 年 09 月 29 日

1 行政院國家科學委員會補助專題研究計畫成果報告

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3 ※ 以資訊不對稱理論建構升級意圖 ※

4 ※ 與前因變項 ※

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1 行政院國家科學委員會專題研究計畫成果報告
2 以資訊不對稱理論建構升級意圖

3 與前因變項

4 Modeling Upgrade Intention and Its Antecedents
5 Based on Information Asymmetry Theory

6 計畫編號：NSC 99-2410-H-263 -004 -

7 執行期限：99年8月1日至100年7月31日

8 主持人：蔡淵輝 致理技術學院財金系

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13 一、中文摘要

14 資訊系統過去的研究與知識主要建立於
15 資訊科技接受與持續使用之觀念，但是
16 卻無法了解使用者是否有意願去進行資
17 訊系統的升級。過去的資訊系統使用模
18 式對於使用者升級意願的了解程度相當
19 有限，因為資訊系統的使用並不代表者
20 資訊系統的升級，使用者使用某種資訊
21 系統並不保證他們一定會進行系統升
22 級。本研究根據資訊不對稱理論提出一
23 個資訊系統升級意願之模式，對於過去
24 探討資訊系統使用的研究模式具有互補
25 的功能。本研究將依據所出的模式進行
26 資料收集與實證，對於資訊系統使用之
27 研究而言，本研究將驗證一個資訊升級
28 之模式同時提供資訊系統廠商建議，以
29 指引廠商如何讓他們自己最新的升級系
30 統獲得市場上使用者的青睞，最後達成
31 使用者升級的目的。

32 **關鍵詞：**使用者的資訊科技接受；資訊
33 不對稱；升級意願；問卷調查

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35 **Abstract**

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40 Much of our prior knowledge of information
41 systems (IS) usage is based on its acceptance

42 or continuance without understanding
43 whether users are likely to upgrade the IS or
44 not. Prior models of IS usage provide a
45 limited understanding of one's intention to
46 upgrade the IS, given that IS usage or
47 continuance does not necessarily suggest the
48 subsequent upgrade of the IS. Even if people
49 use particular IS, there is no guarantee that
50 the users always upgrade the IS. This study
51 proposes an IS upgrade intention model
52 based on the information asymmetry theory
53 to compliment previous studies that mostly
54 focus on IS usage or continuance without
55 considering the possibility of its upgrade.
56 The model of this study will be empirically
57 validated using two surveys of OS (operating
58 systems) usage among more than 500
59 student subjects in two different time points.
60 For IS usage research, this paper proposes
61 and will validate one of the earliest upgrade
62 models of IS. For practitioners, this study
63 will provide some guidelines for IS
64 manufacturers on how to derive the most
65 return on their system development efforts
66 with a successfully high upgrade rate in the
67 market for their newly upgraded systems.

68
69 **Keywords:** User Acceptance of Information
70 Systems, Information Asymmetry, Upgrade
Intention, Questionnaire Surveys.

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2 二、緣由與目的
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4 Despite the importance of IS upgrade for
5 technology industries, research focusing on
6 users' upgrade intention has remained scant
7 suggesting an important research gap. Extant
8 models of IS usage may not provide an
9 adequate understanding of IS upgrade
10 intention due to neglecting users' perceived
11 uncertainty and accessibility of information
12 towards their IS. One important theory that
13 helps explain users' IS upgrade intention is
14 information asymmetry theory since IS
15 upgrade involves uncertainty and the extent
16 of information access clearly addressed in
17 the information asymmetry theory. In
18 economics and contract theory, information
19 asymmetry deals with the study of
20 individuals' decisions in various transactions
21 where individuals have less information than
22 others, leading to an imbalance of power in
23 transactions which can sometimes cause the
24 transactions to go awry (e.g., Bergh, Johnson,
25 & Dewitt, 2008). Individuals' intention to
26 purchase the upgraded version of IS is
27 crucially dependent upon information that is
28 available before the purchase (Nayyar, 1990).
29 In order to make choices for IS upgrade,
30 individuals need to at least know different
31 qualities or attributes of various IS
32 alternatives that they may consider (e.g.,
33 Nayyar, 1990). However, it is difficult for
34 individuals to evaluate a particular IS due to
35 its professionally specialized field. When
36 there exists information asymmetry due to
37 insufficient understanding about IS (e.g.,
38 codified knowledge, detailed analysis, and
39 other information; e.g., Sanders & Boivie,
40 2004), individuals are likely to halt their
41 upgrade.
42 This study first theorizes a research model
43 of IS upgrade intention by drawing on the
44 information asymmetry theory from the
45 economics literature and integrating key
46 tenets of this theory to our IS research model.
47 This approach proposes new relationships
48 and constructs that are salient to

49 understanding the role and scope of IS
50 considerations in terms of its upgrade. The
51 hypothesized model is then empirically
52 tested using two surveys of OS (operating
53 system) usage among undergraduate student
54 subjects in Taiwan. The OS is chosen for this
55 study, because it requires an upgrade once its
56 new version is released by the designers.
57 Undergraduate students were recruited for
58 this study, because this population represents
59 one of the largest user groups of computer
60 software systems (e.g., Photoshop) and OS
61 in particular. Given that most undergraduate
62 students in Taiwan have their own PCs with
63 a lot of different software installed, the
64 question for IS providers is whether these
65 users have an intention to upgrade their IS
66 (or other software) or not. Note that
67 understanding the upgrade issue is important
68 not only for OS inventors or designers, but
69 also for software providers in general who
70 may want to promote their software systems
71 via, for example, electronic commerce (e.g.,
72 online upgrade of anti-virus software
73 systems).

This study differs from previous research
in two critical ways. First, this is the earliest
research to theorize and integrate
information asymmetry within IS upgrade
intention. Although some prior studies have
empirically investigated the effects of
information asymmetry on various IS issues
(e.g., Hogan & Hutson, 2005), no prior study
has examined such effects on IS upgrade
intention. Second, while a majority of prior
empirical studies on information asymmetry
rely on secondary or archival data for
understanding financial cost or profits (e.g.,
Duarte, Han, Harford, & Young, 2008), this
study may be the first to use primary survey
data obtained from real IS users in two
different time points (e.g., prior experiential
factors are surveyed in time 1 whereas some
other factors are surveyed in time 2) to test
the formation of IS upgrade intention.

2. Development of theory and hypotheses

Information asymmetry is defined as the
difference between the information (e.g.,

1 information about operating systems
2 possessed by buyers and sellers (Ba &
3 Pavlou, 2002). Information asymmetry
4 makes it difficult and costly for individuals
5 to ascertain IS attributes before attempts to
6 upgrade the IS are made (Nayyar, 1990). IS
7 is characterized by information asymmetry
8 because the necessary information regarding
9 the latest development and quality of IS
10 products or services may be incomplete or
11 not available obtained by individuals. When
12 individuals perceive substantial information
13 asymmetry without sufficient awareness
14 about IS, they are unlikely to have strong IS
15 upgrade intention.

16 We first take anti-virus software as an
17 example. If users are not well informed
18 about the key differences between the old
19 software they are using and the new software
20 they may upgrade to due to insufficient
21 information (i.e., information asymmetry)
22 they are unlikely to be willing to pay to
23 upgrade their software. For example
24 previous research indicates that the
25 consumer group with symmetric information
26 values the targeted product highly and is in
27 close proximity to the real worth of the
28 product, while the consumer group with
29 asymmetric information undervalues the
30 targeted product (Afzal, Roland, & Al-Squri
31 2009), implying a potential negative
32 relationship between information asymmetry
33 and upgrade intention. Thus, we hypothesize
34 that users' information asymmetry about IS
35 is negatively associated with their future IS
36 upgrade intention.

37 Uncertainty is defined as the extent to
38 which IS is unreliable or untrustworthy in
39 terms of its quality. Individuals' perceived
40 uncertainty is subjective and comes from
41 identifying their goals and matching these
42 goals with a product or service (Park & Stoeberl
43 2005). Given that uncertainty represents
44 potential cost which IS users might bear (e.g.,
45 unreliable quality of current IS may cause a
46 fatal loss of valuable dataset), IS users often
47 take this factor into serious consideration
48 before their final decision of an IS upgrade
49 that is highly related to their cost or risks

Individuals' perceived uncertainty about the
current IS is positively related to their
intention to upgrade the IS, because the
currently high IS uncertainty threatening
users at high cost (risks) is likely to drive
them to improve their situation with the
upgraded IS.

Uncertainty can be seen as a type of
adverse selection (Bergh et al., 2008) in
information asymmetry theory, whereby, for
instance, an individual who is not in optimal
health (i.e., high uncertainty) may be more
inclined to purchase life insurance than
someone who feels fine (i.e., low
uncertainty). In other words, when IS users
perceive their current IS is not trustworthy
and may cause some serious troubles, they
are more likely to be in a hurry to purchase
the upgraded IS due to adverse selection. It
is important to note that previous research
based on information asymmetry theory uses
trust instead of uncertainty for empirical
tests, but these two factors (trust vs.
uncertainty) are actually two sides to one
coin (i.e., they are inverse to each other).
Hence, while this study examines perceived
uncertainty in the upgrade intention
formation, trust is excluded from the
research model of this study to avoid the
overlap of research constructs. Collectively,
when individuals' perceived uncertainty
about their IS is low, they are not likely
willing to upgrade their IS. Thus, we
hypothesize that users' perceived uncertainty
about their current IS is positively associated
with their future IS upgrade intention.

Prior experience refers to a concept that
comprises prior knowledge of or prior
observation of some things gained through
previous involvement in or previous
exposure to things. Prior experience has been
found to be an important antecedent to
individuals' perceived uncertainty in the
entire information process of their choice
(e.g., Bettman & Park, 1980). Indeed,
information asymmetry literature suggests
that products contain high experience
qualities which are the attributes determined
only after consumers have actual experience

1 in using similar products (Kulkarni, 2000)51
2 Specifically, individuals' prior experienc52
3 makes their knowledge more accessible in53
4 memory and also makes low probability54
5 events more salient (Taylor & Todd, 1995)55
6 ensuring that it is accounted for in the56
7 formation process of perceived uncertainty57
8 This implies that the formation of perceiv58
9 uncertainty should be more effectively59
10 modeled by taking different prior experienc60
11 into consideration. Given this, it is importan61
12 to assess different prior experiences in terms62
13 of usefulness and ease of use for63
14 understanding users' perceived uncertainty64
15 towards IS.65

16 Previous studies indicate that two key66
17 reasons for individual use of IS are perceiv67
18 usefulness and perceived ease of use68
19 Perceived usefulness is defined as the69
20 anticipated instrumentality of IS usage fo70
21 improving user task performance71
22 productivity, and effectiveness, while72
23 perceived ease of use is defined as the73
24 degree to which a person expects that using a74
25 particular system will be free of effort75
26 (Venkatesh et al., 2003). Although they ar76
27 both influential to users' perception toward77
28 IS, research suggests, however, that the78
29 degree and impact of perceived usefulness79
30 and perceived ease of use change with thei80
31 prior experience with IS (Gefen, Karahanna81
32 & Straub, 2003). However, previous studie82
33 do not specify what particular prio83
34 experience is, making the prior experienc84
35 an unclear construct for research (Bettman &85
36 Park, 1980). To clarify this issue, this study86
37 proposes that prior experience contains the87
38 prior experience of usefulness and the prio88
39 experience of ease of use. Note tha89
40 perceived usefulness and perceived ease of90
41 use reflect some kinds of users' expectatio91
42 towards IS, while prior experience of92
43 usefulness and prior experience of ease of93
44 use reflect actual and stable behaviora94
45 experience towards the IS rather than95
46 unstable expectation about the IS (Venkates96
47 et al., 2003). Whereas perceived usefulness97
48 and perceived ease of use are individuals'98
49 motivation according to previous research99
50 prior experience of usefulness and prior

experience of ease of use in this study
represent personal characteristics regarding
their IS experience. Given prior experience
is more efficient than expectation in reducing
uncertainty based on information asymmetry
theory (Knill, Minnick, & Nejadmalayeri,
2009), this study hypothesizes the linkage
between prior experience (in terms of
usefulness and ease of use) and perceived
uncertainty. The rationale in detail is
presented in the following.

Searching for information is a key stage
for IS users' decision-making process and
may include a search for both internal and
external information. The users may search
information from different sources in order
to cope with their perceived uncertainty
about the potential positive or negative
consequences (Park & Stoel, 2005). Prior
research in IS and psychology has
established the importance of users' actual
experience in shaping the evolution of
beliefs such as perceived uncertainty or risk
(Park & Stoel, 2005), suggesting the
relationship between prior experience and
perceived uncertainty. For example, internal
information of users will be gathered by
retrieving knowledge from memory such as
prior experience of usefulness, whereas
external information may be collected from
sources such as a reference group (e.g.,
professional group) or the marketplace
(Blackwell, Miniard, & Engel, 2001). Both
internal and external information may reduce
perceived risk (or uncertainty) (Moorthy,
Ratchford, & Talukdar, 1997). If individuals
experience a particular IS to be always
helpful for them to do their job, then they are
unlikely to make a big change on the IS and
their perceived uncertainty about the IS is
likely mitigated, suggesting the negative
relationship between prior experience of
usefulness and perceived uncertainty. Hence,
we propose that users' prior experience of
usefulness is negatively associated with the
perceived uncertainty with their IS.

Taking the case of online shopping for
example, prior experience of ease of use for
the Internet may serve as a form of internal

1 information source and may be associated
2 with perceived uncertainty (or risk) (Park &
3 Stoel, 2005). Prior consumer experience of
4 ease of use in online purchasing (e.g., on
5 click checkout in Amazon.com) has been
6 investigated by some researchers as a
7 consumer characteristic (Elliot & Fowell
8 2000). To the extent that minimal context
9 (i.e., specific system information) is given
10 the users often make system-specific ease of
11 use evaluations based on prior experience
12 with systems (Venkatesh, 2000), implying
13 that the prior experience of ease of use has a
14 positive influence on perceived uncertainty.
15 Specifically, previous research indicates that
16 the initial anchors for system-specific ease of
17 use of a new/target system are expected to
18 ultimately turn to individuals' prior
19 experience with computers/software in
20 general and with other systems (Venkatesh,
21 2000). As users gain experience with the
22 target system (i.e., their assessment of ease
23 of use of the system) (Venkatesh, 2000), they
24 gradually perceive a certain extent of
25 uncertainty based on the experience,
26 suggesting the relationship between users'
27 prior experience of ease of use and their
28 perceived uncertainty.

29 Previous research indicates that users
30 may terminate the learning process about the
31 product before the entire embedded value of
32 a product is realized or even before their
33 utility is maximized due to their experience
34 of learning difficulty or product complexity
35 (i.e., negative prior experience of ease of use)
36 (Chen & Noori, 2005). For example, the
37 systems that are experienced by users who
38 write computer programs to execute job
39 functions (i.e., negative experience of ease of
40 use) have more uncertainty to the users than
41 the systems that are experienced by the users
42 who easily use Windows interface to execute
43 the functions (i.e., positive experience of
44 ease of use), revealing the negative
45 relationship between prior experience of ease
46 of use and subsequent perceived uncertainty.
47 Hence, we propose that users' prior
48 experience of ease of use is negatively
49 associated with the perceived uncertainty
50 with their IS.

Previous studies propose that consumers
search for information to deal with
uncertainty and improve the consequences of
a purchase decision that may be risky to
them (Park & Stoel, 2005). Thus,
professionals are one of the major influences
on an individual's adoption of innovations
due to his or her perceived low uncertainty
(Wheeler, 2008). Professional influence
occurs when an individual's thoughts or
actions are affected by members of a
vocation founded upon specialized
educational training.

The success of an external search to
reduce uncertainty or risks relies on the
amount of an internal search on the extent of
prior experience with the product or service
(Elliot & Fowell, 2000) and that of
professional information available (e.g., Kim
& Lennon, 2000), implying the potential
relationship between prior professional
influence and perceived uncertainty. For
example, apparel shoppers using the Internet
seek professional information or
recommendations to reduce uncertainty in
decision-making, because of their inability to
inspect or try on the garment (Park & Stoel,
2005). Professional influence about the
product such as descriptions of the item and
brand name as well as store policies should
be clearly presented to reduce subsequent
uncertainty or risk (Kwon et al., 1991).
Similarly, it is found that the perceived
amount of product or service information
provided by professionals is negatively
related to perceived risk in television
shopping (Kim & Lennon, 2000), potentially
suggesting a negative relationship between
prior professional influence and
consequently perceived uncertainty.
Therefore, the last hypothesis is "prior
professional influence on users is negatively
associated with the perceived uncertainty
with their IS."

三、結果與討論

3.1 Subjects

1 Our hypothesized research model was
2 empirically tested using two surveys of
3 operation systems (OS) usage among the
4 same undergraduate student subjects
5 Subjects based on class were drawn from the
6 student population of a large national
7 technology university in Taiwan. Particularly
8 classes were first drawn using a stratified
9 random sampling across different colleges in
10 the university, including college of
11 management, college of engineering, college
12 of humanities and applied sciences, and
13 college of design. All the students in our
14 selected classes were surveyed. This
15 procedure was employed to ensure that we
16 had a broad cross-section of the student
17 population and to avoid the potential biasing
18 of the sample that could possibly arise if
19 only MIS students or only seniors were
20 employed. Survey data were collected at two
21 points in time, spaced two months apart
22 Subjects were given class time to fill out
23 both surveys, linked by a four-digit identifier
24 (the last four digits of their home or cell
25 phone number). More specifically, two
26 questionnaires were distributed in two
27 different time points to the same subjects.

29 3.2 Results

30 3.2.1 Data Analysis

31 The survey data were analyzed using
32 two-step structural equation modeling (SEM)
33 approach consisting of measurement and
34 structural model testing (Anderson and
35 Gerbing, 1988). Empirical results from each
36 stage of analysis are presented in the
37 following.

39 3.2.2 Measurement Model

40 In the test results for CFA, the normed fit
41 index (NFI), non-normed fit index (NNFI)
42 comparative fit index (CFI), and goodness of
43 fit index (GFI) all equaled or exceeded 0.90
44 while the adjusted goodness of fit index
45 (AGFI) was only slightly lower than 0.90
46 These indices show a pretty nice goodness of
47 fit in our study. Moreover, the root mean
48 square residual (RMR) was smaller than the

recommended maximum of 0.05, and the
root mean square error of approximation
(RMSEA) was also smaller than the
recommended maximum of 0.08 (Bentler &
Bonnett, 1980), providing strong evidence
herein of the model's satisfactory fit.

Convergent validity was identified by
examining the three following conditions
(Fornell and Larcker, 1981). Consequently,
the empirical data in this study assure
convergent validity. This study applies
chi-square different tests to evaluate
discriminant validity, because the advantage
of such tests is in the simultaneous pair-wise
comparisons for the constructs based on the
Bonferroni method.

3.2.3 Structural Model

The second step in our analysis was to
examine our structural model for the path
coefficient and significance of each of our
hypothesized paths and the variance
explained for each of our dependent
variables.

Four out of our five paths in the structural
model were significant at the $p < 0.01$ level,
and these empirical test results show that
only hypothesis H4 is not supported, while
hypotheses H1, H2, H3, and H5 are
supported in this study. The insignificant
model path (i.e., H4) implies that the critical
role of IS prior experience in terms of ease
of use may weaken as time goes by (e.g.,
after two months in this study), suggesting
that IS providers should pay closer attention
to learn about users' prior experience in
terms of usefulness and prior professional
influence for discovering their perceived
uncertainty. Nevertheless, the unexpected
results for the unsupported hypothesis H4
may warrant further study so that the insights
behind the insignificant models paths can be
interpreted accurately.

3.3 Discussion

Unlike much previous research that
focused on only a limited aspect of prior
experience, this study provides a more

1 comprehensive conceptual definition that
2 disaggregates the content of prior experience
3 into two distinct and separable constructs:
4 prior experience of usefulness and prior
5 experience of ease of use. These constructs
6 help open the “black box” of information
7 systems and explore specific system
8 experiences and their relationships with the
9 cognitive perception (i.e., perceived
10 uncertainty) that consequently affects their
11 upgrade intention. While some previous
12 studies suggest the importance of both
13 usefulness and ease of use in the formation
14 of IS usage of continuance, this study finds
15 that, when these two kinds of perceptions
16 turn into users’ prior experiences (e.g., prior
17 experience of usefulness), only prior
18 experience of usefulness has a significant
19 influence on their perceived uncertainty
20 about the IS.

21 Ignored by previous studies, professional
22 considerations such as prior professional
23 influence in this study show evidence of a
24 significant influence for explaining
25 perceived uncertainty that boosts IS upgrade
26 intention. These findings reinforce our initial
27 contention that the previous IS models (e.g.
28 TAM or UTAUT) may be ill-suited to
29 explaining IS upgrade intention. Particularly
30 the empirical findings of this study present
31 important complements for previous studies
32 that have only examined general prior social
33 influence in users’ social circles (e.g., family
34 relatives, and friends) rather than prior
35 professional influence in the expertise
36 contexts of information technology.

37 Last but not least, this study presents the
38 phenomenon that information asymmetry is
39 harmful for one’s upgrade intention. In other
40 words, upgrade intention is likely boosted
41 when users become acquainted with IS
42 having more accessible information. This
43 aspect is often overlooked by traditional IS
44 models. Future IS researchers should
45 exercise judgment in deciding whether or not
46 to retain informational factors (e.g.,
47 asymmetrical information) in their research
48 models, with due consideration to the
49 informational implications of the IS under
50 investigation.

四、計畫成果自評

We have demonstrated overall that both prior experience of usefulness and prior professional influence affect users’ IS upgrade intention through perceived uncertainty, while the upgrade intention is directly affected by information asymmetry. Nevertheless, there may be additional prior system experiences or attributes potentially relevant for system upgrade intention, which are left open for future research.

Finally, this project has been written as a research paper submitted to a SSCI journal titled Social Science Journal.

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「第二屆ICEE電子商務與電子政務國際學術研討會」
The 2nd International Conference on E-Business and E-Government (ICEE 2011)

論文發表與心得報告

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一、參加會議經過

本次參加的會議下列主辦單位所共同籌辦，參加會議經過如下：

舉辦單位：IEEE主辦，上海大學和上海商學院共同承辦

會議名稱：ICEE 2011

地點：上海

會議時間：2011年5月6日至8日

本人於2011年5月份參與在上海所舉辦的國際學術研討會，此次出國發表所參加的會議是"The 2nd International Conference on E-Business and E-Government (ICEE 2011)"，該會議與會人士來自世界各國，與會學者人數眾多，可藉由會議研討及互動分享等多種方式聆聽各方學者專家研究發現，議題內容非常豐富，尤其是Green It，已成為本次會議焦點。同時也遇見一些相同領域研究學者，共同討論未來合作的可能性。

本研討會議程共有三天，由於本次為國際學術研討會，但因為主辦單位關係，全程中文及英文皆可為發表語言，但大都以英語為主。每一個時段都有多個場次論文發表同時進行，除了美國學者外，同時有許多的參與者來自於不同國家，包括日本、新加坡、印度、泰國、澳洲等等。

本人的論文發表的日期為5月7日下午，發表文章為Modeling Upgrade Intention and Its Antecedents Based on Information Asymmetry Theory，論文報告過程中亦進行問題發問與討論，在與其他先進進行的討論過程中，本人也學習了一些研究上的相關新知，相信有助於未來研究品質之提升。

二、與會心得

經過本次研討會之參與，不但吸取許多充實的研究經驗，對管理領域的研究有更深的體會，且首度接觸「Green IT」這個領域的學者，收獲匪淺。由於本人抱著一個學習與觀摩的心情來參加該次盛大的國際學術研討會，因此出席這場國際會議讓本人吸收了許多和研究相關的寶貴經驗，此外透過本研討會之參與而認識一些國外及大陸學者，建立良好的學術交流基礎。參加國際研討會也可以獲取國際的最新資訊，並且得到研究領域中的發展趨勢之新觀點，這是沒有辦法在國內透過上網就可以體會到的內涵，這也是此行最大的收獲。

從參加的專家學者在本次國際研討會中的演講與論文報告範圍來檢視，可以確定的是該研討會是一場極為成功的國際研討會。因此，本人應該在未來應該更加積極參與類似的國際研討會，以提升個人在學術上的能見度，並將這些見聞與經驗分享給同學們。

三、攜回資料名稱及內容

論文集光碟資料一份；會議議程資料一份。

四、結論

除了發表論文之外，在參加本次的研討會過程中，本人也出席了許多其他場次的研討會，更讓本人瞭解現今研究發展趨勢，同時本人也與其他參與的學者專家進行知識分享，如何綠化自己的研究領域成為自己的首要之務，而節能減碳也成為主流，即使IT也不例外。最後，由於本次研討會的出席經驗，本人對於籌辦國際研討會的專業與經驗，有更加深入的認識，同時增廣了個人的見聞。

Acceptance Notification

Nov.18th, 2010

Dear Author,

Congratulations! It is our great pleasure to inform you that your paper

Paper ID: X543330

Author: Yuan-Hui Tsai

Title: Modeling Upgrade Intention and Its Antecedents Based on Information Asymmetry Theory

has been accepted for presentation at the 2nd International Conference on E-Business and E-Government (ICEE 2011).

All accepted conference papers will be published by IEEE, included in the IEEE eXplore, and indexed by Ei Compendex.

Thank you for submitting paper to ICEE 2011 and we look forward to seeing you at the conference. We also hope that you will contribute your excellent work to future ICEE conferences.

For more information, please visit the conference website.
(<http://www.icee-meeting.org/2011>).

Best regards,

ICEE Organizing Committee



Modeling Usage Intention and Its Antecedents

Based on Information Asymmetry Theory

Abstract

Much of our prior knowledge of information systems (IS) usage is based on its acceptance or continuance without understanding whether users are likely to upgrade the IS or not. Prior models of IS usage provide a limited understanding of one's intention to upgrade the IS, given that IS usage or continuance does not necessarily suggest the subsequent upgrade of the IS. Even if people use particular IS, there is no guarantee that the users always upgrade the IS. This study proposes an IS upgrade intention model based on the information asymmetry theory to compliment previous studies that mostly focus on IS usage or continuance without considering the possibility of its upgrade. The model of this study will be empirically validated using two surveys of OS (operating systems) usage among more than 500 student subjects in two different time points. For IS usage research, this paper proposes and will validate one of the earliest upgrade models of IS. For practitioners, this study will provide some guidelines for IS manufacturers on how to derive the most return on their system development efforts with a successfully high upgrade rate in the market for their newly upgraded systems.

Keywords: User Acceptance of Information Systems, Information Asymmetry, Upgrade Intention, Questionnaire Surveys.

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Despite the importance of IS upgrade for technology industries, research focusing on users' upgrade intention has remained scant, suggesting an important research gap. Extant models of IS usage may not provide an adequate understanding of IS upgrade intention due to neglecting users' perceived uncertainty and accessibility of information towards their IS. One important theory that helps explain users' IS upgrade intention is information asymmetry theory since IS upgrade involves uncertainty and the extent of information access clearly addressed in the information asymmetry theory. In economics and contract theory, information asymmetry deals with the study of individuals' decisions in various transactions where individuals have less information than others, leading to an imbalance of power in transactions which can sometimes cause the transactions to go awry (e.g., Bergh, Johnson, & Dewitt, 2008). Individuals' intention to purchase the upgraded version of IS is crucially dependent upon information that is available before the purchase (Nayyar, 1990). In order to make choices for IS upgrade, individuals need to at least know different qualities or attributes of various IS alternatives that they may consider (e.g., Nayyar, 1990). However, it is difficult for individuals to evaluate a particular IS due to its professionally specialized field. When there exists information asymmetry due to insufficient understanding about IS (e.g., codified knowledge, detailed

analysis, and other information; e.g., Sanders & Boivie, 2004), individuals are likely to halt their upgrade.

This study first theorizes a research model of IS upgrade intention by drawing on the information asymmetry theory from the economics literature and integrating key tenets of this theory to our IS research model. This approach proposes new relationships and constructs that are salient to understanding the role and scope of IS considerations in terms of its upgrade. The hypothesized model is then empirically tested using two surveys of OS (operating system) usage among undergraduate student subjects in Taiwan. The OS is chosen for this study, because it requires an upgrade once its new version is released by the designers. Undergraduate students were recruited for this study, because this population represents one of the largest user groups of computer software systems (e.g., Photoshop) and OS in particular. Given that most undergraduate students in Taiwan have their own PCs with a lot of different software installed, the question for IS providers is whether these users have an intention to upgrade their IS (or other software) or not. Note that understanding the upgrade issue is important not only for OS inventors or designers, but also for software providers in general who may want to promote their software systems via, for example, electronic commerce (e.g., online upgrade of anti-virus software systems).

This study differs from previous research in two critical ways. First, this is the earliest research to theorize and integrate information asymmetry within IS upgrade intention. Although some prior studies have empirically investigated the effects of information asymmetry on various IS issues (e.g., Hogan & Hutson, 2005), no prior study has examined such effects on IS upgrade intention. Second, while a majority of prior empirical studies on information asymmetry rely on secondary or archival data for understanding financial cost or profits (e.g., Duarte, Han, Harford, & Young, 2008), this study may be the first to use primary survey data obtained from real IS users in two different time points (e.g., prior experiential factors are surveyed in time 1 whereas some other factors are surveyed in time 2) to test the formation of IS upgrade intention.

2. Development of theory and hypotheses

Information asymmetry is defined as the difference between the information (e.g., information about operating systems) possessed by buyers and sellers (Ba & Pavlou, 2002). Information asymmetry makes it difficult and costly for individuals to ascertain IS attributes before attempts to upgrade the IS are made (Nayyar, 1990). IS is characterized by information asymmetry, because the necessary information regarding the latest development and quality of IS products or services may be incomplete or not available by individuals. When individuals perceive substantial information asymmetry without sufficient awareness about IS, they are unlikely to have strong IS upgrade intention.

We first take anti-virus software as an example. If users are not well informed about the key differences between the old software they are using and the new software they may upgrade to due to insufficient information (i.e., information asymmetry), they are unlikely to be willing to pay to upgrade their software. For example, previous research indicates that the consumer group with symmetric information values the targeted product

highly and is in close proximity to the real worth of the product, while the consumer group with asymmetric information undervalues the targeted product (Afzal, Roland, & Al-Squri, 2009), implying a potential negative relationship between information asymmetry and upgrade intention. Thus, we hypothesize that users' information asymmetry about IS is negatively associated with their future IS upgrade intention.

Uncertainty is defined as the extent to which IS is unreliable or untrustworthy in terms of its quality. Individuals' perceived uncertainty is subjective and comes from identifying their goals and matching these goals with a product or service (Park & Stoel, 2005). Given that uncertainty represents potential cost which IS users might bear (e.g., unreliable quality of current IS may cause a fatal loss of valuable dataset), IS users often take this factor into serious consideration before their final decision of an IS upgrade that is highly related to their cost or risks. Individuals' perceived uncertainty about the current IS is positively related to their intention to upgrade the IS, because the currently high IS uncertainty threatening users at high cost (risks) is likely to drive them to improve their situation with the upgraded IS.

Uncertainty can be seen as a type of adverse selection (Bergh et al., 2008) in information asymmetry theory, whereby, for instance, an individual who is not in optimal health (i.e., high uncertainty) may be more inclined to purchase life insurance than someone who feels fine (i.e., low uncertainty). In other words, when IS users perceive their current IS is not trustworthy and may cause some serious troubles, they are more likely to be in a hurry to purchase the upgraded IS due to adverse selection. It is important to note that previous research based on information asymmetry theory uses trust instead of uncertainty for empirical tests, but these two factors (trust vs. uncertainty) are actually two sides to one coin (i.e., they are inverse to each other). Hence, while this study examines perceived uncertainty in the upgrade intention formation, trust is excluded from the research model of this study to avoid the overlap of research constructs. Collectively, when individuals' perceived uncertainty about their IS is low, they are not likely willing to upgrade their IS. Thus, we hypothesize that users' perceived uncertainty about their current IS is positively associated with their future IS upgrade intention.

Prior experience refers to a concept that comprises prior knowledge of or prior observation of some things gained through previous involvement in or previous exposure to things. Prior experience has been found to be an important antecedent to individuals' perceived uncertainty in the entire information process of their choice (e.g., Bettman & Park, 1980). Indeed, information asymmetry literature suggests that products contain high experience qualities which are the attributes determined only after consumers have actual experience in using similar products (Kulkarni, 2000). Specifically, individuals' prior experience makes their knowledge more accessible in memory and also makes low probability events more salient (Taylor & Todd, 1995), ensuring that it is accounted for in the formation process of perceived uncertainty. This implies that the formation of perceived uncertainty should be more effectively modeled by taking different prior experience into consideration. Given this, it is important to assess different prior experiences in terms of usefulness and ease of use for understanding users' perceived uncertainty towards IS.

Previous studies indicate that two key reasons for individual use of IS are perceived usefulness and perceived ease of use. Perceived usefulness is defined as the anticipated

instrumentality of IS usage for improving user task performance, productivity, and effectiveness, while perceived ease of use is defined as the degree to which a person expects that using a particular system will be free of effort (Venkatesh et al., 2003). Although they are both influential to users' perception towards IS, research suggests, however, that the degree and impact of perceived usefulness and perceived ease of use change with their prior experience with IS (Gefen, Karahanna, & Straub, 2003). However, previous studies do not specify what particular prior experience is, making the prior experience an unclear construct for research (Bettman & Park, 1980). To clarify this issue, this study proposes that prior experience contains the prior experience of usefulness and the prior experience of ease of use. Note that perceived usefulness and perceived ease of use reflect some kinds of users' expectation towards IS, while prior experience of usefulness and prior experience of ease of use reflect actual and stable behavioral experience towards the IS rather than unstable expectation about the IS (Venkatesh et al., 2003). Whereas perceived usefulness and perceived ease of use are individuals' motivation according to previous research, prior experience of usefulness and prior experience of ease of use in this study represent personal characteristics regarding their IS experience. Given prior experience is more efficient than expectation in reducing uncertainty based on information asymmetry theory (Knill, Minnick, & Nejadmalayeri, 2009), this study hypothesizes the linkage between prior experience (in terms of usefulness and ease of use) and perceived uncertainty. The rationale in detail is presented in the following.

Searching for information is a key stage for IS users' decision-making process and may include a search for both internal and external information. The users may search information from different sources in order to cope with their perceived uncertainty about the potential positive or negative consequences (Park & Stoel, 2005). Prior research in IS and psychology has established the importance of users' actual experience in shaping the evolution of beliefs such as perceived uncertainty or risk (Park & Stoel, 2005), suggesting the relationship between prior experience and perceived uncertainty. For example, internal information of users will be gathered by retrieving knowledge from memory such as prior experience of usefulness, whereas external information may be collected from sources such as a reference group (e.g., professional group) or the marketplace (Blackwell, Miniard, & Engel, 2001). Both internal and external information may reduce perceived risk (or uncertainty) (Moorthy, Ratchford, & Talukdar, 1997). If individuals experience a particular IS to be always helpful for them to do their job, then they are unlikely to make a big change on the IS and their perceived uncertainty about the IS is likely mitigated, suggesting the negative relationship between prior experience of usefulness and perceived uncertainty. Hence, we propose that users' prior experience of usefulness is negatively associated with the perceived uncertainty with their IS.

Taking the case of online shopping for example, prior experience of ease of use for the Internet may serve as a form of internal information source and may be associated with perceived uncertainty (or risk) (Park & Stoel, 2005). Prior consumer experience of ease of use in online purchasing (e.g., one click checkout in Amazon.com) has been investigated by some researchers as a consumer characteristic (Elliot & Fowell, 2000). To the extent that minimal context (i.e., specific system information) is given, the users often make system-specific ease of use evaluations based on prior experiences with systems (Venkatesh, 2000), implying that the prior experience of ease of use has a positive

influence on perceived uncertainty. Specifically, previous research indicates that the initial anchors for system-specific ease of use of a new/target system are expected to ultimately turn to individuals' prior experience with computers/software in general and with other systems (Venkatesh, 2000). As users gain experience with the target system (i.e., their assessment of ease of use of the system) (Venkatesh, 2000), they gradually perceive a certain extent of uncertainty based on the experience, suggesting the relationship between users' prior experience of ease of use and their perceived uncertainty.

Previous research indicates that users may terminate the learning process about the product before the entire embedded value of a product is realized or even before their utility is maximized due to their experience of learning difficulty or product complexity (i.e., negative prior experience of ease of use) (Chen & Noori, 2005). For example, the systems that are experienced by users who write computer programs to execute job functions (i.e., negative experience of ease of use) have more uncertainty to the users than the systems that are experienced by the users who easily use Windows interface to execute the functions (i.e., positive experience of ease of use), revealing the negative relationship between prior experience of ease of use and subsequent perceived uncertainty. Hence, we propose that users' prior experience of ease of use is negatively associated with the perceived uncertainty with their IS.

Previous studies propose that consumers search for information to deal with uncertainty and improve the consequences of a purchase decision that may be risky to them (Park & Stoel, 2005). Thus, professionals are one of the major influences on an individual's adoption of innovations due to his or her perceived low uncertainty (Wheeler, 2008). Professional influence occurs when an individual's thoughts or actions are affected by members of a vocation founded upon specialized educational training.

The success of an external search to reduce uncertainty or risks relies on the amount of an internal search on the extent of prior experience with the product or service (Elliot & Fowell, 2000) and that of professional information available (e.g., Kim & Lennon, 2000), implying the potential relationship between prior professional influence and perceived uncertainty. For example, apparel shoppers using the Internet seek professional information or recommendations to reduce uncertainty in decision-making, because of their inability to inspect or try on the garment (Park & Stoel, 2005). Professional influence about the product such as descriptions of the item and brand name as well as store policies should be clearly presented to reduce subsequent uncertainty or risk (Kwon et al., 1991). Similarly, it is found that the perceived amount of product or service information provided by professionals is negatively related to perceived risk in television shopping (Kim & Lennon, 2000), potentially suggesting a negative relationship between prior professional influence and consequently perceived uncertainty. Therefore, the last hypothesis is "prior professional influence on users is negatively associated with the perceived uncertainty with their IS."

3.1 Subjects

Our hypothesized research model was empirically tested using two surveys of operation systems (OS) usage among the same undergraduate student subjects. Subjects

based on class were drawn from the student population of a large national technology university in Taiwan. Particularly, classes were first drawn using a stratified random sampling across different colleges in the university, including college of management, college of engineering, college of humanities and applied sciences, and college of design. All the students in our selected classes were surveyed. This procedure was employed to ensure that we had a broad cross-section of the student population and to avoid the potential biasing of the sample that could possibly arise if only MIS students or only seniors were employed. Survey data were collected at two points in time, spaced two months apart. Subjects were given class time to fill out both surveys, linked by a four-digit identifier (the last four digits of their home or cell phone number). More specifically, two questionnaires were distributed in two different time points to the same subjects.

3.2 Results

3.2.1 Data Analysis

The survey data were analyzed using a two-step structural equation modeling (SEM) approach consisting of measurement and structural model testing (Anderson and Gerbing, 1988). Empirical results from each stage of analysis are presented in the following.

3.2.2 Measurement Model

In the test results for CFA, the normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), and goodness of fit index (GFI) all equaled or exceeded 0.90, while the adjusted goodness of fit index (AGFI) was only slightly lower than 0.90. These indices show a pretty nice goodness of fit in our study. Moreover, the root mean square residual (RMR) was smaller than the recommended maximum of 0.05, and the root mean square error of approximation (RMSEA) was also smaller than the recommended maximum of 0.08 (Bentler & Bonnett, 1980), providing strong evidence herein of the model's satisfactory fit.

Convergent validity was identified by examining the three following conditions (Fornell and Larcker, 1981). Consequently, the empirical data in this study assure convergent validity. This study applies chi-square different tests to evaluate discriminant validity, because the advantage of such tests is in the simultaneous pair-wise comparisons for the constructs based on the Bonferroni method.

3.2.3 Structural Model

The second step in our analysis was to examine our structural model for the path coefficient and significance of each of our hypothesized paths and the variance explained for each of our dependent variables.

Four out of our five paths in the structural model were significant at the $p < 0.01$ level, and these empirical test results show that only hypothesis H4 is not supported, while hypotheses H1, H2, H3, and H5 are supported in this study. The insignificant model path (i.e., H4) implies that the critical role of IS prior experience in terms of ease of use may weaken as time goes by (e.g., after two months in this study), suggesting that IS providers

should pay closer attention to learn about users' prior experience in terms of usefulness and prior professional influence for discovering their perceived uncertainty. Nevertheless, the unexpected results for the unsupported hypothesis H4 may warrant further study so that the insights behind the insignificant models paths can be interpreted accurately.

3.3 Discussion

Unlike much previous research that focused on only a limited aspect of prior experience, this study provides a more comprehensive conceptual definition that disaggregates the content of prior experience into two distinct and separable constructs: prior experience of usefulness and prior experience of ease of use. These constructs help open the "black box" of information systems and explore specific system experiences and their relationships with the cognitive perception (i.e., perceived uncertainty) that consequently affects their upgrade intention. While some previous studies suggest the importance of both usefulness and ease of use in the formation of IS usage of continuance, this study finds that, when these two kinds of perceptions turn into users' prior experiences (e.g., prior experience of usefulness), only prior experience of usefulness has a significant influence on their perceived uncertainty about the IS.

Ignored by previous studies, professional considerations such as prior professional influence in this study show evidence of a significant influence for explaining perceived uncertainty that boosts IS upgrade intention. These findings reinforce our initial contention that the previous IS models (e.g., TAM or UTAUT) may be ill-suited to explaining IS upgrade intention. Particularly, the empirical findings of this study present important complements for previous studies that have only examined general prior social influence in users' social circles (e.g., family, relatives, and friends) rather than prior professional influence in the expertise contexts of information technology.

Last but not least, this study presents the phenomenon that information asymmetry is harmful for one's upgrade intention. In other words, upgrade intention is likely boosted when users become acquainted with IS having more accessible information. This aspect is often overlooked by traditional IS models. Future IS researchers should exercise judgment in deciding whether or not to retain informational factors (e.g., asymmetrical information) in their research models, with due consideration to the informational implications of the IS under investigation.

We have demonstrated overall that both prior experience of usefulness and prior professional influence affect users' IS upgrade intention through perceived uncertainty, while the upgrade intention is directly affected by information asymmetry. Nevertheless, there may be additional prior system experiences or attributes potentially relevant for system upgrade intention, which are left open for future research.

Finally, this project has been written as a research paper submitted to a SSCI journal titled *Social Science Journal*.

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國科會補助計畫衍生研發成果推廣資料表

日期:2011/09/29

國科會補助計畫	計畫名稱: 以資訊不對稱理論建構升級意圖與前因變項
	計畫主持人: 蔡淵輝
	計畫編號: 99-2410-H-263-004- 學門領域: 資訊管理
無研發成果推廣資料	

99 年度專題研究計畫研究成果彙整表

計畫主持人：蔡淵輝		計畫編號：99-2410-H-263-004-				計畫名稱：以資訊不對稱理論建構升級意圖與前因變項	
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	100%		
		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	2	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	1	100%		
		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（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%		

<p>其他成果 (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。)</p>	<p>無</p>
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	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

達成目標

未達成目標（請說明，以 100 字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表 未發表之文稿 撰寫中 無

專利： 已獲得 申請中 無

技轉： 已技轉 洽談中 無

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）

資訊系統過去的研究與知識主要建立於資訊科技接受與持續使用之觀念，但是卻無法了解使用者是否有意願去進行資訊系統的升級。過去的資訊系統使用模式對於使用者升級意願的了解程度相當有限，因為資訊系統的使用並不代表者資訊系統的升級，使用者使用某種資訊系統並不保證他們一定會進行系統升級。本研究根據資訊不對稱理論提出一個資訊系統升級意願之模式，對於過去探討資訊系統使用的研究模式具有互補的功能。本研究將依據所出的模式進行資料收集與實證，對於資訊系統使用之研究而言，本研究將驗證一個資訊升級之模式同時提供資訊系統廠商建議，以指引廠商如何讓他們自己最新的升級系統獲得市場上使用者的青睞，最後達成使用者升級的目的。