國 立 交 通 大 學

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碩 士 論 文

科技接受模式之擴散與主要趨勢研究：使用共引文分析方法

Technology Acceptance Model: Dissemination and Main Trends,
Using Co-citation Analysis

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碩 士 論 文

A Thesis

Submitted to Institute of Business and Management

College of Management

National Chiao Tung University

in Partial Fulfillment of the Requirements

for the Degree of

Master of Business Administration

June 2009

Taipei, Taiwan, Republic of China

中 華 民 國 九 十 八 年 六 月

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摘　　　要

本論文以書目計量法(bibliometrics)中之文章共引文分析法(document co-citation analysis)為量化基礎，針對科技接受模式(technology acceptance model, TAM)於已收錄在社會科學引文索引SSCI中之所有相關研究期刊文獻為資料主體，以統計套裝軟體SPSS為工具進行統計方法量化分析，企圖找出學界在科技接受模式研究裡之主要研究類別以及研究趨勢，並試圖提供未來可行研究建議。

本研究發現，目前學界中科技接受模式的相關文獻出現兩大主要研究趨勢，一為探討在不同資訊科技(如 e-mail、電子商務等)的應用下，科技接受模式的應用效果；另一為將科技接受模式與其他使用者心理行為研究理論結合，試圖整合出更加完整健全的新模型以全面描述使用者接受資訊科技時的意圖、態度、行為等心理過程。研究最後建議未來對於科技接受模式有興趣之研究者，可以新興科技為使用媒介的電子商務(如行動商務、互動電視商務)等進行使用者接受之心理過程及影響因素探討。

關鍵字：科技接受模式、共引文分析法、電子商務

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ABSTRACT

In this study, we investigate the dissemination on technology acceptance model (TAM) with document co-citation analysis of the inductive bibliometrical methods. After factor analysis, cluster analysis and multidimensional scaling, the current studies represent these dissemination: (1) appliance of technology acceptance model in different IT context; (2) extended technology acceptance model and combination of diversified theories. And four major groups of IT context are applied in: (1) job-related IT; (2) information-acquiring IT for knowledge management; (3) leisure IT; and (4) e-commerce. With the historical diffusion of TAM, we suggest studies on e-commerce with emerging media and new technology adoption are still popular in the future.

Keyword: technology acceptance model, co-citation analysis, e-commerce

誌　　　謝

　　論文的完成，代表在交大兩年的修業完成。

　　兩年的時間，不算長也不說短，卻遇到足以影響我生命的一群人，包括老師們、學長姐以及同學等等。在所上所有老師們的指導下，學會自我學習的技巧以及獨立思考的習慣，這將是日後得以不斷自我終身學習的重要技能；楊千教授與君華學姐的論文指導，提供了細部個別的學習觀點，加上同學間的互相切磋討教，大家激盪出新的火花。最可貴的是同儕兩年的情誼，相互間沒有利害關係的心靈契合，這樣的友情相信會持續一輩子。

　　感謝命運安排我進入交大，學到一輩子都有用的知識，以及認識一輩子知心的好友。這一切的一切，最終都帶來了人生中最寶貴的財富，即是再多擁有一些「選擇的權力」，人生多一點選擇，也就多一點自由，希望大家都能擁有自己最想要的自由。

　　最後感謝這一路上所有支持我的人。但要感謝的人實在太多了，在此就感謝天吧！所有的細節，將放在心上細細回味，留待成為大夥日後相聚時的茶酒良伴。

　　願上天賜福大家，人生一切平安順利。

<div align="right">
高麒紜

2009 年 6 月 24 日

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Content

List of Table

List of Figure

I. Introduction

<u>Research Motive</u>

Information technology offers the potential and convenient tools for improving work performance and life quality (Curley, 1984; Edelman, 1981; Sharda, et al., 1988), but performance gains are largely affected by user willingness to accept and use these available systems (Thompson et al., 1991). Numerous studies have presented various theories to investigate the process how human beings' acceptance toward using new information system is affected, such as model of PC utilization (MPCU) (Thompson et al., 1991), theory of reasoned action (TRA) (Ajzen and Fishbein, 1980), and the combined TAM and TPB (C-TAM-TPB) (Taylor and Todd, 1995). Besides, a lot of models highlight independent variables to probe into what factors may exert influences on user acceptance, such as self-efficacy (Bandura, 1982), the trade-off between cost and benefit (Beach & Mitchell, 1978; Johnson & Payne, 1985), compatibility, relative advantage, and complexity (Tornatzky & Klein, 1982; Rogers & Shoemaker, 1971), the perceived importance and perceived usableness (Larker & Lessig, 1980), and the psychological trade-off between information quality and costs of access (Swanson, 1982, 1987). These theories and models provide diverse perspectives to explain what affects user acceptance to IT.

One of the most powerful and parsimonious theories to describe such influence toward attitude to adopt new technology is technology acceptance model (TAM), which is advanced by Fred D. Davis in his doctorial dissertation of 1986. TAM provides an efficient measurement scales for predicting user acceptance of information technology. This model proposes two variables, which are perceived usefulness (PU) and perceived ease of use (PEOU), to be the fundamental determinants of user attitude toward acceptance of new technology.

Since TAM was proposed, a lot of research studies have been carried out to extend to different aspects. For instance, additional variables have been added to explain other influences to adoption (Venkatesh and. Davis, 2000; Chau, 1996). A lot of practical applications in purchasing behavior in e-commerce (Gefen, Karahanna, and Straub, 2003) and individual and organizational adoption to different electronic products (Amoako-Gyampah and Salam 2003; Lu, et al., 2003) are quite common. The development and evolution related to technology acceptance from TAM are unclear now.

Research Method

This study aims to employ an inductive perspective with bibliometrical methods to explore the trends and academic groups of TAM research. Bibliometrics provides a tool to document the intellectual development of the ideas represented by published studies in journals of Social Science Citation Index (SSCI) based on a document co-citation analysis. The co-citation analysis is one form of document coupling to measure the number of documents which have cited any given pair of documents (Garfield, 1979; Small, 1973). The number of times that two documents are cited jointly in the same work can determine how close two documents relate to each other and identify groups of closely related documents as considering to belong to the same "research front" (Price, 1965). Through the systematical analysis, an objective perspective to examine the evolution and trends (Ramos-Rodrigues and Ruiz-Navarro, 2004) of TAM-related studies could be presented.

Research Questions

Resulting from the above literature and method review, this paper targets four research topics:

(1) The intellectual subfields emerging from research related to TAM.
(2) The interrelations among these subfields.
(3) The evolutions of these subfields emerged from TAM research.
(4) The research front on TAM research.

Research Procedure

The research structure of this study will be organized into four parts. Firstly, we will review literatures associated to TAM. Secondly, we will delineate the method we use to systematically analyze these data we gather from social science journals database, such as SSCI (social science citation index). That is co-citation analysis. Thirdly, a statistical analysis of document co-citation, and further examination of factor analysis, cluster analysis, and multidimensional scaling(MDS) to give a panoramic view of the present research. Finally, we will give a general discussion and then advance some suggestions for future study.

II. Literature Review

Technology Acceptance Model

Technology Acceptance Model (TAM), which is introduced by Fred D. Davis in 1986, provides efficient measurement scales for predicting user acceptance of information technology (IT). TAM proposes two variables to be the fundamental determinants – perceived usefulness (PU) and perceived ease of use (PEOU) – toward user attitude to use information technology systems. TAM suggests that perceived usefulness has a significantly greater influence on attitude toward acceptance to new information system than perceived ease of use does (Davis, 1986). This model also suggests that perceived ease of use (PEOU) may actually be a causal antecedent to perceived usefulness (PU), as opposed to a parallel, direct determinant of system usage (Davis, 1989). The model is shown in Figure 1.
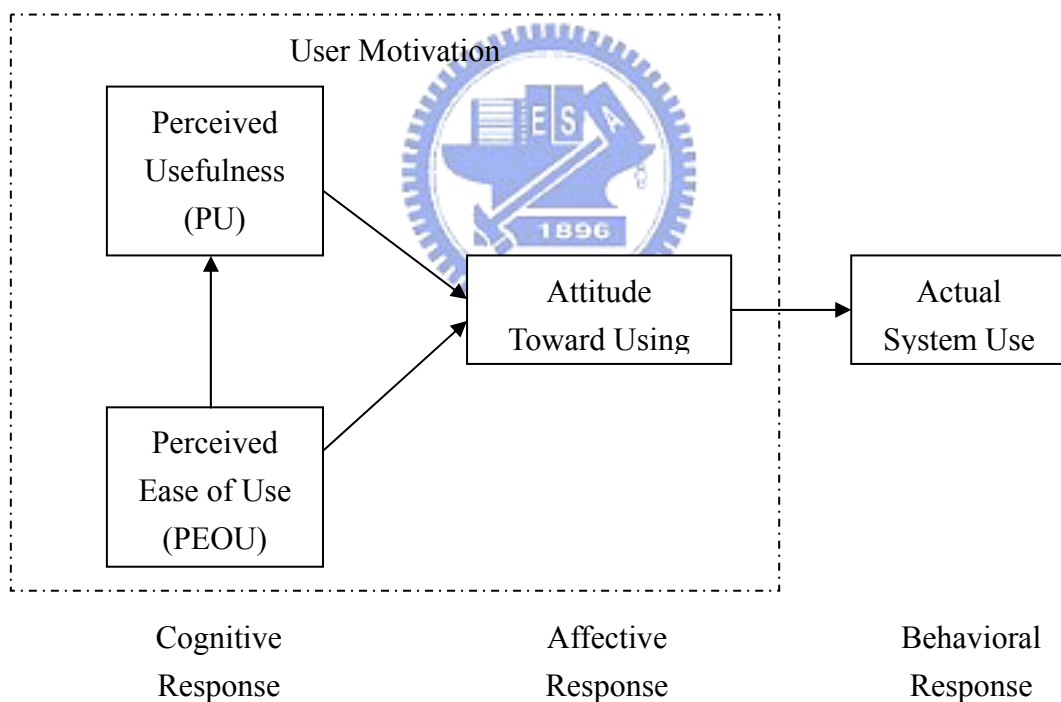

Figure 1 Technology Acceptance Model by Fred D. Davis, 1986

A lot of papers give further research on these two factors – perceived usefulness (PU) and perceived ease of use (PEOU) – in TAM. These studies attempt to explore more determinants that may exert influence on PU and PEOU, respectively, in TAM.

Some Critical Papers on TAM

TAM is derived from the theory of reasoned action (TRA). TRA is derived from the social psychology setting and it indicates that a person's behavioral intention depends on his/her attitude concerning the behavior and subjective norms. In 1986, Davis suggests TAM which is applied TRA in IT contexts. TAM focuses on the two constructs (PU and PEOU) that specially influence attitude. Now, TAM is a powerful and widely employed model on IT adoption.

Venkatesh and Davis (1996) conduct a study to discuss the antecedents of perceived ease of use. They suggested that general computer self-efficacy has an impact on ease of use perceptions at all times, and objective usability has an impact on ease of use perceptions about a specific IT system only after direct experience with the IT system.

The following the study in 1996 with Davis and Venkatesh (2000) further tests an anchoring and adjustment-based theoretical model of the determinants of system-specific perceived ease of use. The model proposes control (conceptualized as computer self-efficacy and perceptions of external control), emotion (conceptualized as computer anxiety), and intrinsic motivation (conceptualized as computer playfulness) as anchors that determine early perceptions about the ease of use of a new IT system. With increasing experience, the perceived ease of use will adjust to reflect objective usability, perceptions of external control, and perceived enjoyment.

Venkatesh and Davis (2000) also propose a theoretical extension of the TAM, which is referred to as TAM 2, to explain perceived usefulness and usage intention in terms of social influence and cognitive instrumental processes. The work examines longitudinal data collected through pre-implementation and post-implementation of four months. The TAM 2 shows that both social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceives ease of use) have significant influences on user acceptance toward IT.

Electronic commerce, commonly known as e-commerce, is a set of behavior to buy and sell products or services over electronic systems such as the Internet. The amount of e-commerce has grown fast and commonly accepted because of widespread Internet usage. Any successful e-vendor is attempting to attract new customers and retain them. Research (Gefen, Karahanna, and Straub, 2003) has shown two sets of usage antecedents that may affect on-line customers to stay with the e-commerce website: (1) customer trust in the e-vender, and (2) customer assessments to the website itself, specially the perceived usefulness and perceived ease of use as depicted

in the technology acceptance model (TAM). A number of replications widely discuss TAM in the e-commerce context.

III. Methodology

3.1 Co-citation Method

The present paper analyzes a set of relevant publications or papers with bibliometric method. Bibliometrics is a set of methods which are used to study or measure texts and information. Co-citation analysis is one of commonly used bibliometric methods. Co-citation, which is a measure related to bibliographic coupling, was introduced by Small in 1973 (Jarneving, 2005). This form of document coupling is defined as the frequency of two documents cited together. The strength of co-citation is defined as the number of identical citing items (Jarneving, 2005). The more often two documents are cited together, the closer the relation between them is (White and Griffith, 1981). Nevertheless, the relation only means that these authors discuss the same issue. They do not necessarily agree with each other (Acedo, Barroso, and Galan, 2006).

The justification of this work is based on a core principle: the bounded rationality of individuals (Simon, 1957). It is very difficult to keep current with the development and trends of an expanding and diverse subject (Acedo, Barroso, and Galan, 2006). It is likely that analysis occurs biases by researchers' own cognitive barriers that are determined by the personal circumstances, including their education, experiences, and social groups to which they belong (Acedo, Barroso, and Galan, 2006). Co-citation analysis provides an objective method with mathematical and statistical quantification. The major utility of bibliometric co-citation analysis as a research methodology is on the assumption that bibliographic citations are an acceptable proxy for the actual influence of various information sources on a research project (Culnan, 1986).
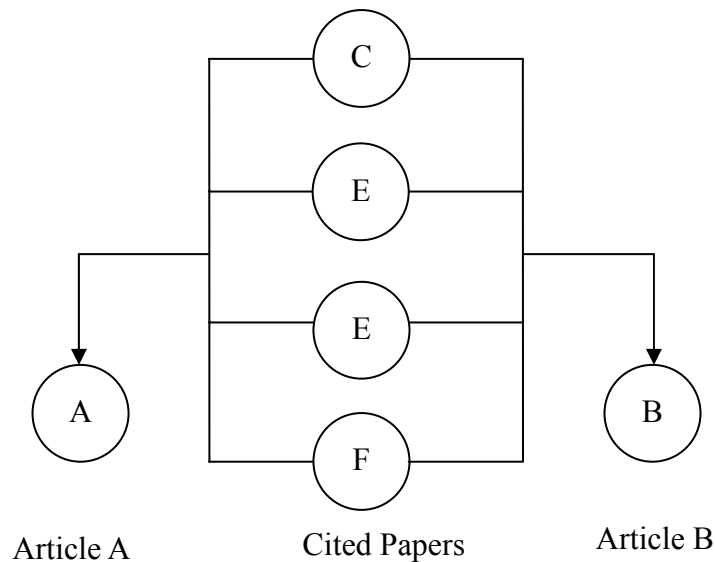
Article A and B are associated because both of them are cited by papers C, D, E and F.

Figure 2   Concept of Co-citation Analysis

Modified from: Garfield E, 2001

With co-citation analysis, the relation among our core papers will be revealed. From these connections, our core papers can be classified and the trend how our target topic – TAM – has been developed could be studied. Based on this TAM development trend, suggestions could be given for the possibly future study worthy to do.

3.2 Data Collection and Analysis

3.2.1 Research Procedure

The complete procedure of this research is shown in Figure3. In the beginning, we identified our core research papers by selecting the highly cited documents about TAM in ISI database. Then we retrieved the co-citation counts for each pair of the selected core documents to compile the raw co-citation matrix. Starting from the co-citation matrix, we estimated the Pearson's correlation matrix with the statistics software package-SPSS. With this correlation, three data analysis are performed: (1) factor analysis, (2) cluster analysis, and (3) multidimensional scaling (MDS). From the statistics analysis, the historical dissemination of TAM might be unveiled.
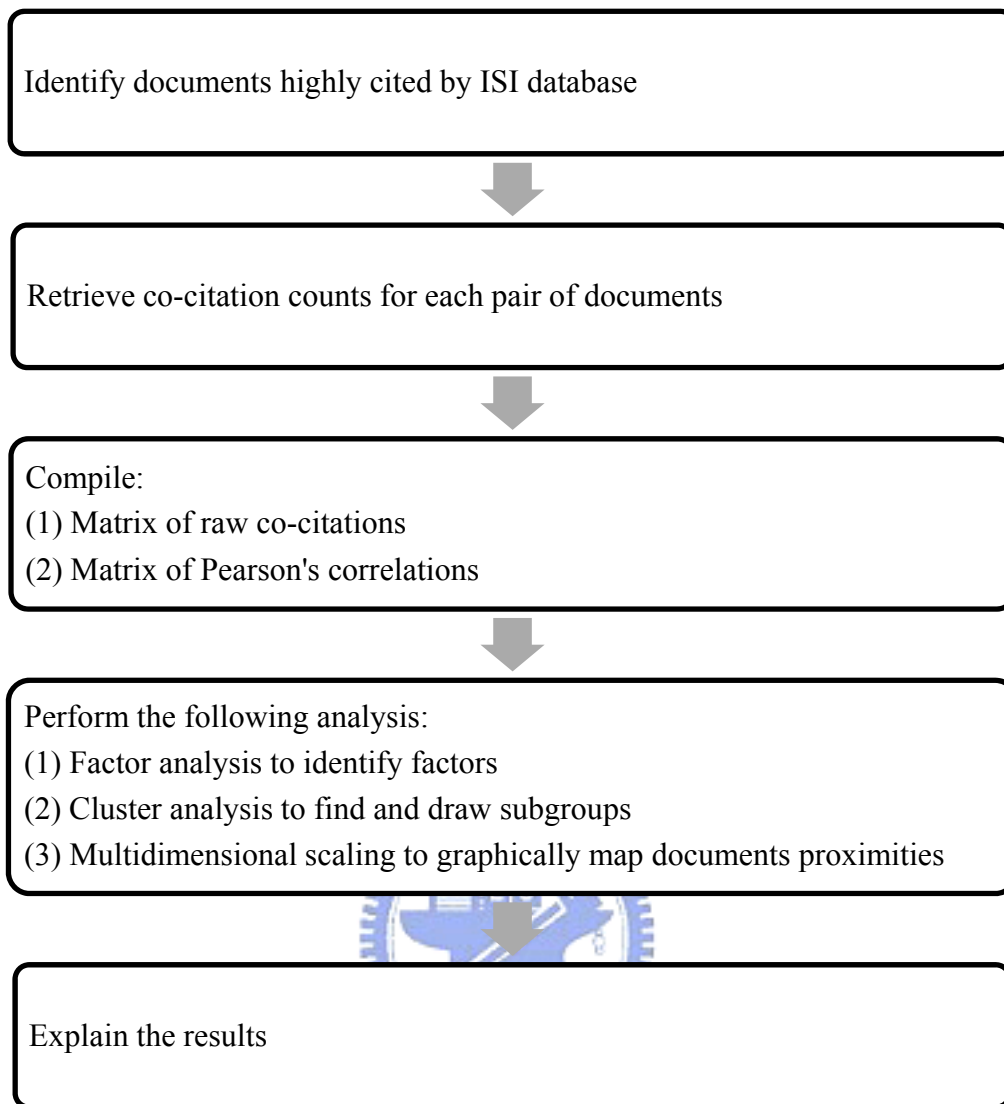
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│                                                        │
│  Identify documents highly cited by ISI database       │
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│  Compile:                                              │
│  (1) Matrix of raw co-citations                        │
│  (2) Matrix of Pearson's correlations                  │
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│  Perform the following analysis:                       │
│  (1) Factor analysis to identify factors               │
│  (2) Cluster analysis to find and draw subgroups       │
│  (3) Multidimensional scaling to graphically map documents proximities │
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│  Explain the results                                   │
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Figure 3   Research Procedure

3.2.2 Data Selecting

In order to explore the trend of TAM development, we planned to analyze the relation among some papers which we consider as important TAM articles in academic field. But what a proper criteria can be used for deciding research papers on TAM as important articles? The research papers on TAM that are published in SSCI[1] journals collected for the present research. On January 1st, 2009, we searched the articles with the key word "technology acceptance model" in SSCI database.

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[1] SSCI: Social Sciences Citation Index. SSCI is the most famous and powerful accreditation in social science developed the Institute for Scientific Information (ISI), the US. SSCI is an interdisciplinary citation index product of Thomson Scientific. This citation database covers more than 1,700 of the world's leading journals of social sciences, and more than 50 disciplines online. This database product provides information to identify the articles cited most frequently and by what publisher and author.
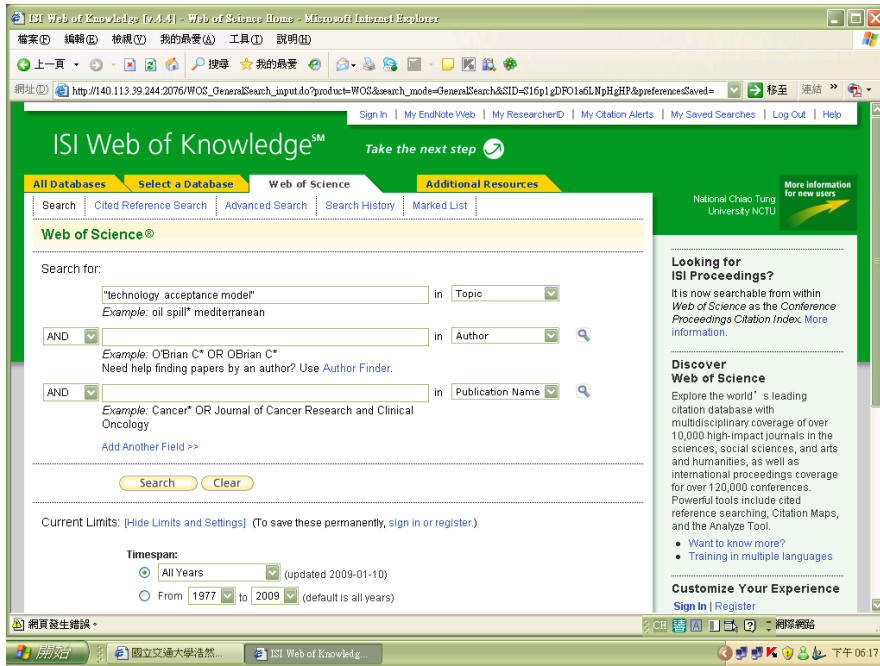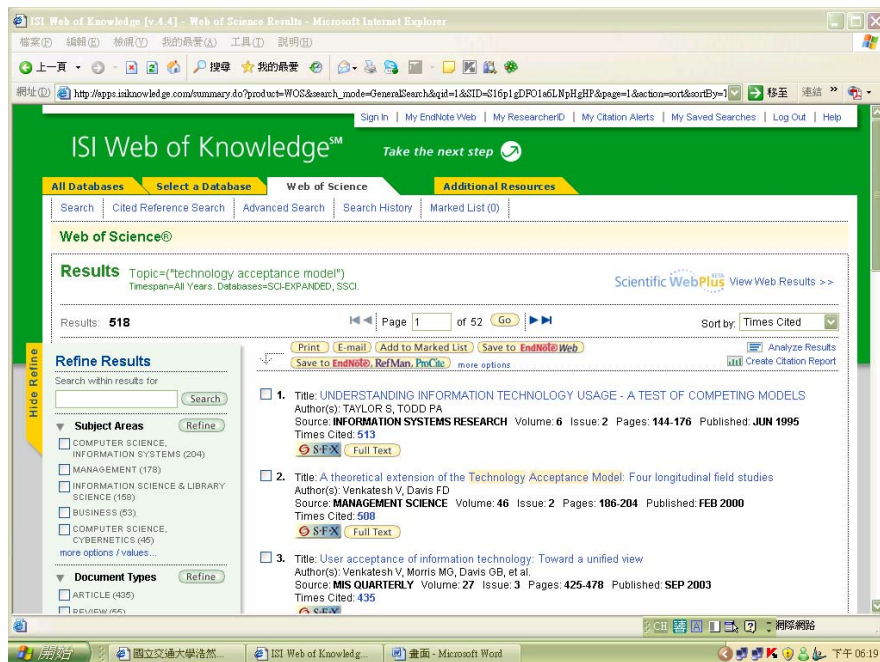
Figure 4   SSCI Database

Figure 5   Result of TAM Paper-Searching in ISI Database

The result shows that there are 518 papers that their research topics are about "technology acceptance model" (Figure 5). According to the reference paper " The Intellectual Development of Management Information Systems, 1972-1982: A Co-Citation Analysis" by Mary J. Culnan, 1986, the author chooses 30 or more times that a paper had been cited to retained for subsequent co-citation analysis (Culnan, 1986). We collected the research papers on TAM that had been cited 30 or more times from 1977 to January 1st, 2009. This procedure results in a list of 65 papers received

between 513 and 30 cited times. But this collection is clearly not exhaustive of the articles which are currently published in the SSCI journals. The later the papers are published, the lesser the cited times they have. Only two articles published in 2005 and no one published after 2006 are collected in our research pool. This phenomenon is called "publication lag" due to the fact that a number of years are required for published articles to be subsequently cited. To reduce the possible bias due to publication lags, we enlarged our collection of the core papers which have 20 or more cited times published after 2005 (Acedo, Barroso, and Galan, 2006). Another six articles published after 2005 are included in our research pool. Last, we added the most important article on TAM in our research pool. That is "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology" in MIS Quarterly by Davis, FD, 1989. This article is generally considered as the first article proposed the TAM concept in academic journals. The whole procedure finally resulted in 72 articles to our research pool. The list of these 72 core papers are shown in Table 1, Table 2, and Table 3.

Table 1　Core Set Documents I

No.	Author	Year	Title	Source	Impact Factor	Cited Times
1	Davis	1989	Perceived usefulness, perceived ease of use, and user acceptance of information technology	MIS Quarterly	5.826	1583
2	Taylor et al.	1995	Understanding information technology usage: a test of competing models	Information Systems Research	2.682	513
3	Venkatesh et al.	2000	A theoretical extension of the technology acceptance model: four longitudinal field studies	Management Science	1.931	508
4	Venkatesh et al.	2003	User acceptance of information technology: toward a unified view	MIS Quarterly	5.826	435
5	Venkatesh et al.	2000	Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model	Information Systems Research	2.682	257
6	Gefen et al.	2003	Trust and TAM in online shopping: an integrated model	MIS Quarterly	5.826	254
7	Venkatesh et al.	1996	A model of the antecedents of perceived ease of use: development and test	Decision Sciences	1.435	243
8	Venkatesh et al.	2000	Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior	MIS Quarterly	5.826	223
9	Gefen et al.	1997	Gender differences in the perception and use of E-mail: an extension to the technology acceptance model	MIS Quarterly	5.826	210
10	Szajna	1996	Empirical evaluation of the revised technology acceptance model	Management Science	1.931	196
11	Igbaria et al.	1997	Personal computing acceptance factors in small firms: a structural equation model	MIS Quarterly	5.826	188
12	Taylor et al.	1995	Assessing IT usage: the role of prior experience	MIS Quarterly	5.826	171
13	Moon et al.	2001	Extending the TAM for a World-Wide-Web context	Information & Management	1.631	162
14	Agarwal et al.	1999	Are individual differences germane to the acceptance of new information technologies?	Decision Sciences	1.435	158
15	Koufaris et al.	2002	Applying the technology acceptance model and flow theory to online consumer behavior	Information Systems Research	2.682	155
16	Straub et al.	1995	Measuring system usage: implication for IS theory testing	Management Science	1.931	145
17	Hu et al.	1999	Examining the technology acceptance model using physician acceptance of telemedicine technology	Journal of Management Information Systems	1.867	141
18	Venkatesh	1999	Creation of favorable user perceptions: exploring the role of intrinsic motivation	MIS Quarterly	5.826	140
19	Legris et al.	2003	Why do people use information technology? A critical review of the technology acceptance model	Information & Management	1.631	139
20	Bhattacherjee	2001	Understanding information systems continuance: an expectation-confirmation model	MIS Quarterly	5.826	135
21	Lederer et al.	2000	The technology acceptance model and the World Wide Web	Decision Sciences	1.119	125
22	Chin et al.	1995	On the use, usefulness, and ease of use of structural equation modeling in MIS research: a note of caution	MIS Quarterly	5.826	115
23	Devaraj et al.	2002	Antecedents of B2C channel satisfaction and preference: validating e-commerce metrics	Information Systems Research	2.682	107
24	Jackson et al.	1997	Toward an understanding of the behavioral intention to use an information system	Decision Sciences	1.435	107
25	Karahanna et al.	1999	The psychological origins of perceived usefulness and ease-of-use	Information & Management	1.631	98
26	Dishaw et al.	1999	Extending the technology acceptance model with task-technology fit constructs	Information & Management	1.631	97
27	Pavlou	2003	Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model	International Journal of Electronic Commerce	1.186	88

Table 2　Core Set Documents II

No.	Author	Year	Title	Source	Impact Factor	Cited Times
28	Chen et al.	2002	Enticing online consumers: an extended technology acceptance perspective	Information & Management	1.631	88
29	Igbaria et al.	1995	Effects of self-efficacy on computer usage	Omega-International Journal of Management Science	1.327	86
30	Agarwal et al.	2002	Assessing a firm's Web presence: a heuristic evaluation procedure for the measurement of usability	Information Systems Research	2.682	80
31	Straub et al.	1997	Testing the technology acceptance model across cultures: a three country study	Information & Management	1.631	73
32	Venkatesh et al.	2001	A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges	MIS Quarterly	5.826	67
33	Chau et al.	2001	Information technology acceptance by individual professionals: a model comparison approach	Decision Sciences	1.435	65
34	Lucas et al.	1999	Technology use and performance: a field study of broker workstations	Decision Sciences	1.435	63
35	Lin et al.	2000	Towards an understanding of the behavioural intention to use a web site	International Journal of Information Management	0.451	62
36	Wu et al.	2005	What drives mobile commerce? An empirical evaluation of the revised technology acceptance model	Information & Management	1.631	60
37	Davis et al.	1996	A critical assessment of potential measurement biases in the technology acceptance model: three experiments	International Journal of Human-Computer Studies	1.364	57
38	van der Heijden	2004	User acceptance of hedonic information systems	MIS Quarterly	5.826	56
39	Chau et al.	2002	Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories	Information & Management	1.631	54
40	Plouffe et al.	2001	Research report: richness versus parsimony in modeling technology adoption decisions -understanding merchant adoption of a smart card-based payment system	Information Systems Research	2.682	54
41	Doll et al.	1998	Using Davis's perceived usefulness and ease-of-use instruments for decision making: a confirmatory and multigroup invariance analysis	Decision Sciences	1.435	53
42	Wixom et al.	2005	A theoretical integration of user satisfaction and technology acceptance	Information Systems Research	2.682	52
43	Bhattacherjee	2001	An empirical analysis of the antecedents of electronic commerce service continuance	Decision Sciences	1.119	52
44	Grandon et al.	2004	Electronic commerce adoption: an empirical study of small and medium US businesses	Information & Management	1.631	47
45	Gefen et al.	2003	Inexperience and experience with online stores: the importance of TAM and trust	IEEE Transactions on Engineering Management	0.962	45
46	van der Heijden	2003	Factors influencing the usage of websites: the case of a generic portal in The Netherlands	Information & Management	1.631	45
47	Briggs et al.	2003	Collaboration engineering with ThinkLets to pursue sustained success with group support systems	Journal of Management Information Systems	1.867	45
48	Hsu et al.	2004	Why do people play on-line games? An extended TAM with social influences and flow experience	Information & Management	1.631	44
49	Bagozzi et al.	1992	Development and test of a theory of technological learning and usage	Human Relations	1.103	43
50	Al-Gahtani et al.	1999	Attitudes, satisfaction and usage: factors contributing to each in the acceptance of information technology	Behaviour & Information Technology	1.028	42

Table 3　Core Set Documents III

No	Author	Year	Title	Source	Impact Factor	Cited Times
51	Hong et al.	2001	Determinants of user acceptance of digital libraries: an empirical examination of individual differences and system characteristics	Journal of Management Information Systems	1.867	41
52	Hackbarth et al.	2003	Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use	Information & Management	1.631	39
53	Vijayasarathy	2004	Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model	Information & Management	1.631	38
54	Gefen et al.	1998	The impact of developer responsiveness on perceptions of usefulness and ease of use: an extension of the technology acceptance model	Data Base For Advances in Information Systems	-	38
55	Pavlou et al.	2006	Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior	MIS Quarterly	5.826	37
56	Bruner et al.	2005	Explaining consumer acceptance of handheld Internet devices	Journal of Business Research	0.878	37
57	Morris et al.	1997	How user perceptions influence software use	IEEE Software	1.462	37
58	Yi et al.	2003	Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model	International Journal of Human-Computer Studies	1.364	36
59	Sussman et al.	2003	Informational influence in organizations: an integrated approach to knowledge adoption	Information Systems Research	2.682	36
60	Riemenschneider et al.	2003	Understanding it adoption decisions in small business: integrating current theories	Information & Management	1.631	36
61	Luarn et al.	2005	Toward an understanding of the behavioral intention to use mobile banking	Computers in Human Behavior	1.344	34
62	Shih	2004	An empirical study on predicting user acceptance of e-shopping on the Web	Information & Management	1.631	33
63	Amoako et al.	2004	An extension of the technology acceptance model in an ERP implementation environment	Information & Management	1.631	31
64	Nysveen et al.	2005	Intentions to use mobile services: antecedents and cross-service comparisons	Journal of Management Information Systems	1.18	30
65	Ong et al.	2004	Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies	Information & Management	1.631	30
66	Featherman et al.	2003	Predicting e-services adoption: a perceived risk facets perspective	International Journal of Human-Computer Studies	1.364	30
67	Carter et al.	2005	The utilization of e-government services: citizen trust, innovation and acceptance factors	Information Syatems Journal	1.531	26
68	Shang et al.	2005	Extrinsic versus intrinsic motivations for consumers to shop on-line	Information & Management	1.631	25
69	Saade et al.	2005	The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model	Information & Management	1.631	22
70	Lee et al.	2005	Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation	Information & Management	1.631	20
71	Yu et al.	2005	Extending the TAM for a t-commerce	Information & Management	1.631	20
72	Lai et al.	2005	Technology acceptance model for internet banking: an invariance analysis	Information & Management	1.631	20

3.2.3 Co-citation Analysis

Based on these 72 core papers, we collected every paper citing our core papers from ISI database. 7133 citing papers in total are collected as the data to build our co-citation matrix. The co-citation matrix is shown in Table 4. This co-citation matrix is the starting point of this present inductive analysis. The first row and column of this 72 squared matrix are the numbers of our core papers. The figures in the boxes indicate the number of papers that cite each pair of our core papers.

Using SPSS, the co-citation matrix is transferred into the Pearson's correlation matrix that is shown in Table 5. These correlation quotients can be the indicators of similarities between the co-citation profiles of two core papers. There are two advantages of using correlations instead of counts of co-citations. One is to standardize the data in order to avoid the scale effects caused by the number of citation consisting different documents. Another is to reduce the number of zeros existing in the matrix that can cause problems in the statistics application. (Francisco Jos'e Acedo, et al., 2006)

Table 4   Co-citation Matrix

Table 5   Pearson's Correlation Matrix

IV. Results

4.1 Factor Analysis

Factor analysis is a statistical method used to describe variability among original variables in terms of fewer unobserved variables called factors. The motivation for reducing the dimension when analyzing multi-response data is a balance between attainment of parsimony for understanding and the retention of sufficient information for adequate analysis (Mark L. Berenson, et al., 1983). Using factor analysis, we can identify the salient groups of documents that define historical trends within TAM.

Three factors are chosen to explain 82.40 percent of the variance (Table 6). Table7 shows the results of factor analysis with varimax rotation. Varimax rotation has the advantage of showing the loads on more than one factor and expresses the importance of the variables loading on a given factor.

Table 6 Explanation of Total Variance

Extracted Components	Eigenvalues	% of Variance Accounted for	Cumulative Variance
1	44.57	59.12	59.12
2	10.12	14.06	73.18
3	6.62	9.19	82.40

Table 7　Factor Analysis I

No.	Title	Components		
		1	2	3
19	Why do people use information technology? A critical review of the technology acceptance model	0.983		
25	The psychological origins of perceived usefulness and ease-of-use	0.973		
18	Creation of favorable user perceptions: exploring the role of intrinsic motivation	0.968		
17	Examining the technology acceptance model using physician acceptance of telemedicine technology	0.966		
12	Assessing IT usage: the role of prior experience	0.962		
14	Are individual differences germane to the acceptance of new information technologies?	0.959		
7	A model of the antecedents of perceived ease of use: development and test	0.956		
9	Gender differences in the perception and use of E-mail: an extension to the technology acceptance model	0.954		
8	Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior	0.954		
26	Extending the technology acceptance model with task-technology fit constructs	0.952		
33	Information technology acceptance by individual professionals: a model comparison approach	0.950		
16	Measuring system usage: implication for IS theory testing	0.948		
5	Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model	0.948		
10	Empirical evaluation of the revised technology acceptance model	0.947		
29	Effects of self-efficacy on computer usage	0.945		
11	Personal computing acceptance factors in small firms: a structural equation model	0.941		
40	Research report: richness versus parsimony in modeling technology adoption decisions-understanding merchant adoption of a smart card-based payment system	0.935		
31	Testing the technology acceptance model across cultures: a three country study	0.935		
41	Using Davis's perceived usefulness and ease-of-use instruments for decision making: a confirmatory and multigroup invariance analysis	0.933		
13	Extending the TAM for a World-Wide-Web context	0.928		
37	A critical assessment of potential measurement biases in the technology acceptance model: three experiments	0.924		
50	Attitudes, satisfaction and usage: factors contributing to each in the acceptance of information technology	0.919		
24	Toward an understanding of the behavioral intention to use an information system	0.912		
4	User acceptance of information technology: toward a unified view	0.912		
34	Technology use and performance: a field study of broker workstations	0.912		
28	Enticing online consumers: an extended technology acceptance perspective	0.911		
39	Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories	0.909		
3	A theoretical extension of the technology acceptance model: four longitudinal field studies	0.909		
22	On the use, usefulness, and ease of use of structural equation modeling in MIS research: a note of caution	0.904		
2	Understanding information technology usage: a test of competing models	0.900		

Table 8　Factor Analysis II

No.	Title	Components		
		1	2	3
54	The impact of developer responsiveness on perceptions of usefulness and ease of use: an extension of the technology acceptance model	0.898		
51	Determinants of user acceptance of digital libraries: an empirical examination of individual differences and system characteristics	0.894		
21	The technology acceptance model and the World Wide Web	0.872		
65	Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies	0.869		
52	Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use	0.849		
6	Trust and TAM in online shopping: an integrated model	0.832		
49	Development and test of a theory of technological learning and usage	0.826		
63	An extension of the technology acceptance model in an ERP implementation environment	0.816		
58	Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model	0.808		
57	How user perceptions influence software use	0.803		
20	Understanding information systems continuance: an expectation-confirmation model	0.793		
60	Understanding it adoption decisions in small business: integrating current theories	0.788		
32	A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges	0.763		
70	Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation	0.753		
1	Perceived usefulness, perceived ease of use, and user acceptance of information technology	0.729		
15	Applying the technology acceptance model and flow theory to online consumer behavior	0.725		
69	The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model	0.718		
36	What drives mobile commerce? An empirical evaluation of the revised technology acceptance model	0.681		
35	Towards an understanding of the behavioural intention to use a web site	0.651		
48	Why do people play on-line games? An extended TAM with social influences and flow experience	0.651		
38	User acceptance of hedonic information systems	0.649		
46	Factors influencing the usage of websites: the case of a generic portal in The Netherlands	0.591		
27	Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model		0.878	
55	Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior		0.837	
23	Antecedents of B2C channel satisfaction and preference: validating e-commerce metrics		0.766	
42	A theoretical integration of user satisfaction and technology acceptance		0.730	
30	Assessing a firm's Web presence: a heuristic evaluation procedure for the measurement of usability		0.718	
45	Inexperience and experience with online stores: the importance of TAM and trust		0.683	
66	Predicting e-services adoption: a perceived risk facets perspective		0.662	

Table 9　Factor Analysis III

No.	Title	Components		
		1	2	3
67	The utilization of e-government services: citizen trust, innovation and acceptance factors		0.623	
43	An empirical analysis of the antecedents of electronic commerce service continuance		0.553	
61	Toward an understanding of the behavioral intention to use mobile banking		0.553	
44	Electronic commerce adoption: an empirical study of small and medium US businesses		-0.432	
47	Collaboration engineering with ThinkLets to pursue sustained success with group support systems		-0.391	
53	Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model			0.725
68	Extrinsic versus intrinsic motivations for consumers to shop on-line			0.705
72	Technology acceptance model for internet banking: an invariance analysis			0.659
64	Intentions to use mobile services: antecedents and cross-service comparisons			0.649
71	Extending the TAM for a t-commerce			0.633
56	Explaining consumer acceptance of handheld Internet devices			0.610
59	Informational influence in organizations: an integrated approach to knowledge adoption			-0.607
62	An empirical study on predicting user acceptance of e-shopping on the Web			0.579

From the above factor analysis, we can group 72 core papers into 3 main factors to discuss (Table 10 and Table 11).

Table 10   Factor Identification I

Factor	Factor Name	Number of Core Set Papers
1	TAM development and IT application	19, 25, 18, 17, 12, 14, 7, 9, 8, 26, 33, 16, 5, 10, 29, 11, 40, 31, 41, 13, 37, 50, 24, 4, 34, 28, 39, 3, 22, 2, 54, 51, 21, 65, 52, 6, 49, 63, 58, 57, 20, 60, 32, 70, 1, 15, 69, 36, 35, 48, 38, 46
Summary		

(1) **Other factors affecting users' intention, attitude, and actual behavior of IT adoption :** PU, PEOU, social norms, gender, cost, computer anxiety, risk, trust, enjoyment, and so on (Davis, 1985, 1989; Venkatesh, et al., 2000; Gefen, et al., 2003; Taylor, et al., 1995).

(2) **Combination with other adoption-assessing model :** Theory of planned behavior (TPB)、task-technology model (TTM)、innovation diffusion theory (IDT), and others (Taylor, et al., 1995; Dishaw, et al., 1999; Chen, et al., 2002).

(3) **Applied to work-related IT :** Word processor, email, voice mail, telemedicine technology, etc.(Agarwal, et al., 1999; Gefen , et al., 1997; Straub, et al., 1995; Hu, et al., 1999), e-learning (Ong, et al.,2004), ERP (Amoako-Gyampah, et al., 2004)

Table 11　Factor Identification II

Factor	Factor Name	Number of Core Set Papers
2	Online shopping	27, 55, 23, 42, 30, 45, 66, 67, 43, 61, 44, 47
Summary		
(1)　Published after 2001		
(2)　Users' adoption (Pavlou, 2003; Grandon, et al., 2004; Gefen, et al., 2003) and selection (Devaraj, et al., 2002) about online shopping based on TAM.		
Factor	**Factor Name**	**Number of Core Set Papers**
3	E-commerce with new technology	53, 68, 72, 64, 71, 56, 59, 62
Summary		
(1)　Published after 2001, or fresher		
(2)　The infrastructure and efficiency of Internet bandwidth ↑, wireless devices and novel interactive electronical devices, emerging e-commerce have been paid more attention to. 　　EX:　mobile-commerce (Bruner et al., 2005; Nysveen, et al., 2005) and shopping with iTV (an interactive TV to facilitate the purchase of goods and services in the home using remote control instead of a telephone) (Yu, et al., 2005) are discussed in this subgroup.		

Factor 1 : TAM development and IT application

Factor 1 consists of 52 papers in Table7, 8, and 9. The commonality of the topics of these papers is about the TAM development and IT application. Factor 2 consists of 12 papers in Table7, 8, and 9. They are commonly interested in the user adoption of online shopping. 8 papers are grouped in Factor 3 in Table7, 8, and 9. These papers almost discuss the user adoption in emerging technology such as mobile commerce and t-commerce (using interactive television, iTV).

From these three main factors, the dissemination of TAM is unveiled. The largest part of the dissemination is model developing. In factor 1, to complete and ensure TAM proposed by Davis in 1986, many research have been conducted to test factors affecting users' intention, attitude, and actual behavior of IT adoption, such as PU, PEOU, social norms, gender, cost, computer anxiety, risk, trust, enjoyment, and so on

(Davis, 1985, 1989; Venkatesh, et al., 2000; Gefen, et al., 2003; Taylor, et al., 1995). But the frameworks of these replications are still constructed on the basis of TAM. It shows that TAM is generally considered as a simple but effective fundamental model. Some studies compare TAM with other adoption-assessing model, such as theory of planned behavior (TPB), task-technology model (TTM), innovation diffusion theory (IDT), and so on (Taylor, et al., 1995; Dishaw, et al., 1999; Chen, et al., 2002). This subgroup represents some researchers attempt to form a more comprehensive model to get better understanding about how users' IT adoption is affected. In this group, TAM are applied in work-related IT (word processor, email, voice mail, telemedicine technology, etc.) (Agarwal, et al., 1999; Gefen , et al., 1997; Straub, et al., 1995; Hu, et al., 1999), e-learning (Ong, et al.,2004), ERP (Amoako-Gyampah, et al., 2004), and so on.

Factor 2 and Factor 3: E-commerce

Articles in factor 2 and factor 3 generally concentrate on e-commerce. All of them are published after 2001. As the Internet has gone from novelty to utility for many households, increasing number of customers are spending more time shopping electronically for books, music, and airline tickets (Devaraj, et al., 2002). Many papers study users' adoption (Pavlou, 2003; Grandon, et al., 2004; Gefen, et al., 2003) and selection (Devaraj, et al., 2002) about online shopping based on TAM. In factor 3, the year of publication of these articles are even fresher than those in factor 2. As increasing of the infrastructure and efficiency of Internet bandwidth, wireless devices and novel interactive electronical devices, emerging e-commerce have been paid more attention to. For example, mobile-commerce (Bruner et al., 2005; Nysveen, et al., 2005) and shopping on iTV[2] (Yu, et al., 2005) are discussed in this subgroup. From the above discussion, we can induce the trend of TAM study evolving from basic model developing on work-related IT to the adoption to e-commerce.

4.2 Cluster Analysis

The objective of cluster analysis is to develop subgroups such that objects within a particular subgroup (called cluster) are more like other objects within this subgroup than they are like objects in a different subgroup (Mark L. Berenson, et al., 1983). Hence, the outcome of cluster analysis is to develop a classification scheme that provides the sequence of groupings by which a set of objects is subdivided (Mark L.

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[2] iTV is an interactive TV to facilitate the purchase of goods and services in the home using remote control instead of a telephone

Berenson, et al., 1983). We use agglomerative (buttom-up) hierarchical algorithm to find successive clusters using previously established clusters. The squared Euclidean distance is selected as the distance measure. We use Ward Method to link the articles together in clusters.

The following dendrogram (Figure 6) shows the result of the agglomerative hierarchical clustering.

Figure 6　Hierarchical Cluster Analysis

From the above cluster analysis, we can group these 72 core papers into two main clusters. And also, in cluster 1, two subgroups can be further classified. Figure 7 shows the identification of these clusters.
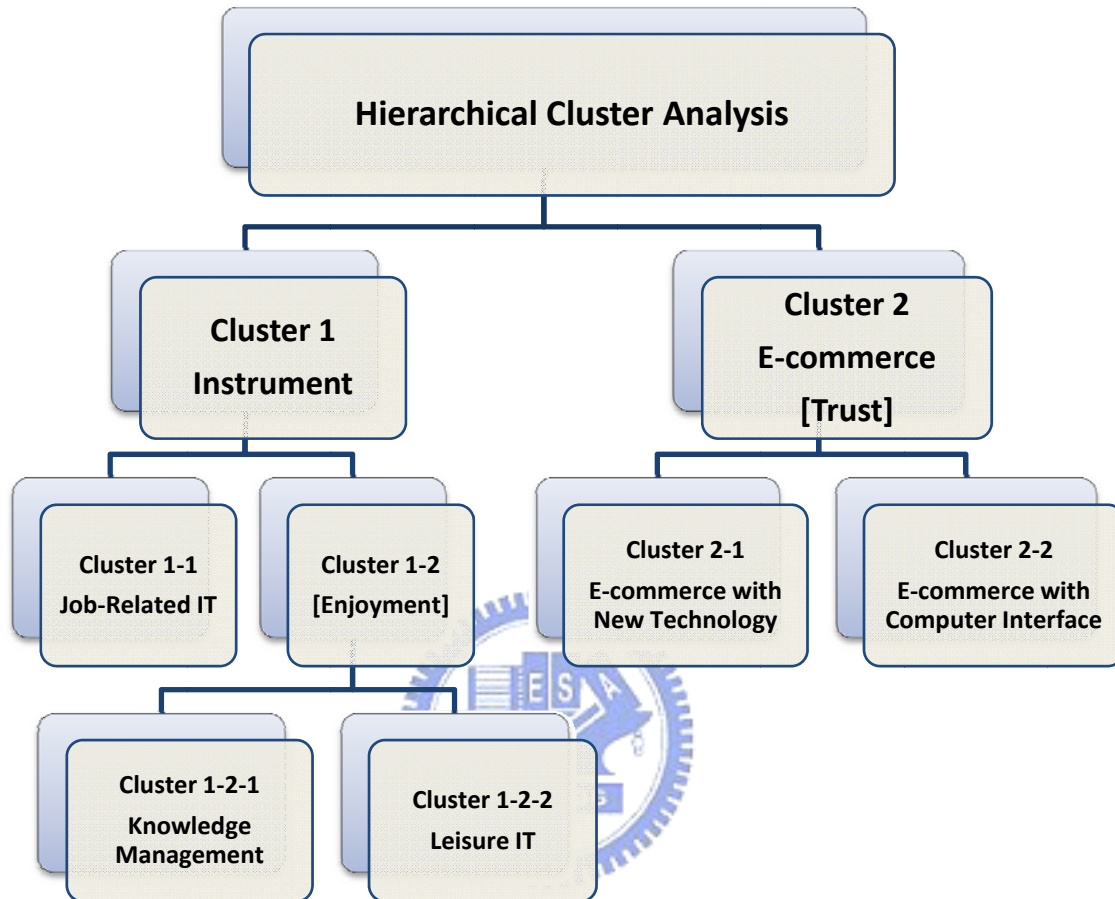
Figure 7   Cluster Identification and Additional Affecting Factors

Cluster 1 : Instrument with Variable "Enjoyment" Partially

Compiled in Figure 7, cluster 1 comprises 53 core papers. Similar with factor 1, the commonality of the topics of these papers is also about the TAM development and model testing. However, cluster 1 can be further divided into two subgroups. Cluster 1-1 and cluster 1-2 are composed of 30 and 23 core papers, respectively. In cluster 1-1, studies are commonly interested in job-related IT, such as word processor, email, voice mail, and telemedicine technology. This distinguishing feature shows that in early stage of TAM (proposed in 1986), researchers have applied TAM to work-related IT to test the efficiency of TAM, and tried to modify this model to make it more comprehensive.

Cluster 1-2 represents studies interested in non-work-related IT such as online shopping (Koufaris, 2002), e-learning (Ong, et al., 2004; Saade, et al., 2005), online game (Hsu, et al., 2004), entertainment and information websites (van der Heijden, 2004; Hong, et al., 2001; Venkatesh, et al., 2001). Most of these papers concern about the same additional construct – enjoyment (van der Heijden, 2003; Yi, et al., 2003; Lee, et al., 2005). Other three similar words are used to express the same idea – playfulness (Hackbarth, et al., 2003), flow experience (Koufaris, 2002; Hsu, et al., 2004), and hedonic (Venkatesh, et al., 2001; van der Heijden, 2004). With these two features, it can be inferred that one of main reasons that people continue to use IT after work is enjoyment. The pleasure derived from the consumption, or use, of these IT products(Venkatesh, et al., 2001).

Cluster 2: E-commerce with Variable "Trust"

Cluster 2 is made of 19 core papers. The publication years of these articles are even fresher (9 of 19 papers are published after 2005). Papers in this clusters are commonly emphasize the effect of trust (Pavlou, 2003; Gefen, et al., 2003; Pavlou, et al., 2006; Carter & Belanger, 2005; Yu, et al., 2005). Also, the similar idea is expressed with some other terms. For example, uncertainty (Devaraj, et al., 2002), reliability (Wixom, et al., 2005), confirmation (Bhattacherjee, 2001), credibility (Luarn & Lin, 2005; Sussman & Siegal, 2003), risk (Featherman & Pavlou, 2003), and security (Shih, 2004). This common employment to trust and risk perceptions in the uncertain context of e-commerce shows that people feel uncertain about virtual shops, and the virtual shops which are believed to be honest and reliable are considered to transact with by consumers.

4.3 Multidimensional Scaling (MDS)

Multidimensional scaling (MDS) is a set of related statistical techniques often used in information visualization for exploring similarities or dissimilarities in data. Like principle components and factor analysis, MDS can be categorized as reduction procedures whereby either a measure of similarity or distance between objects is utilized as the basis to form subgroups or determine the dimensions that separate the objects on a geometric map (Mark L. Berenson, et al., 1983).

We use metric MDS to maintain a linear functional relationship between plotted objects and actual distance to deal with interval or ratio level data. After SPSS maps MDS result, two basic aspects need to be considered. One is determination of the proper number of dimensions, another is interpretation of the dimensions. Considering

both the number of dimensions and goodness of fit for the particular configuration obtained, an increase in the number of dimensions will improve the fit of the configuration to the actual data, but increasing dimensionality complicates any analysis. Hence, one of objectives in MDS is to maximize the goodness of fit of the result while minimizing the number of dimensions to be interpreted simply.

Table 12   Stress and Squared Correlation (R^2)

Number of Dimensions	Kruskal's Stress Values	R^2
1	0.24625	0.90798
2	0.18873	0.92447
3	0.15590	0.93684

Table 12 shows that our data reveal a stress of 0.24625 for one dimension, 0.18873 for two dimensions, and 0.15590 for three dimensions. In view of the relatively large difference in stress between one and two dimensions, and relatively small difference between the stress values for two and three dimensions, it would make sense to take the two-dimension configuration presented as Figure 8. The R^2 of two-dimension configuration is 0.92447, which indicates an outstanding fit for our data.
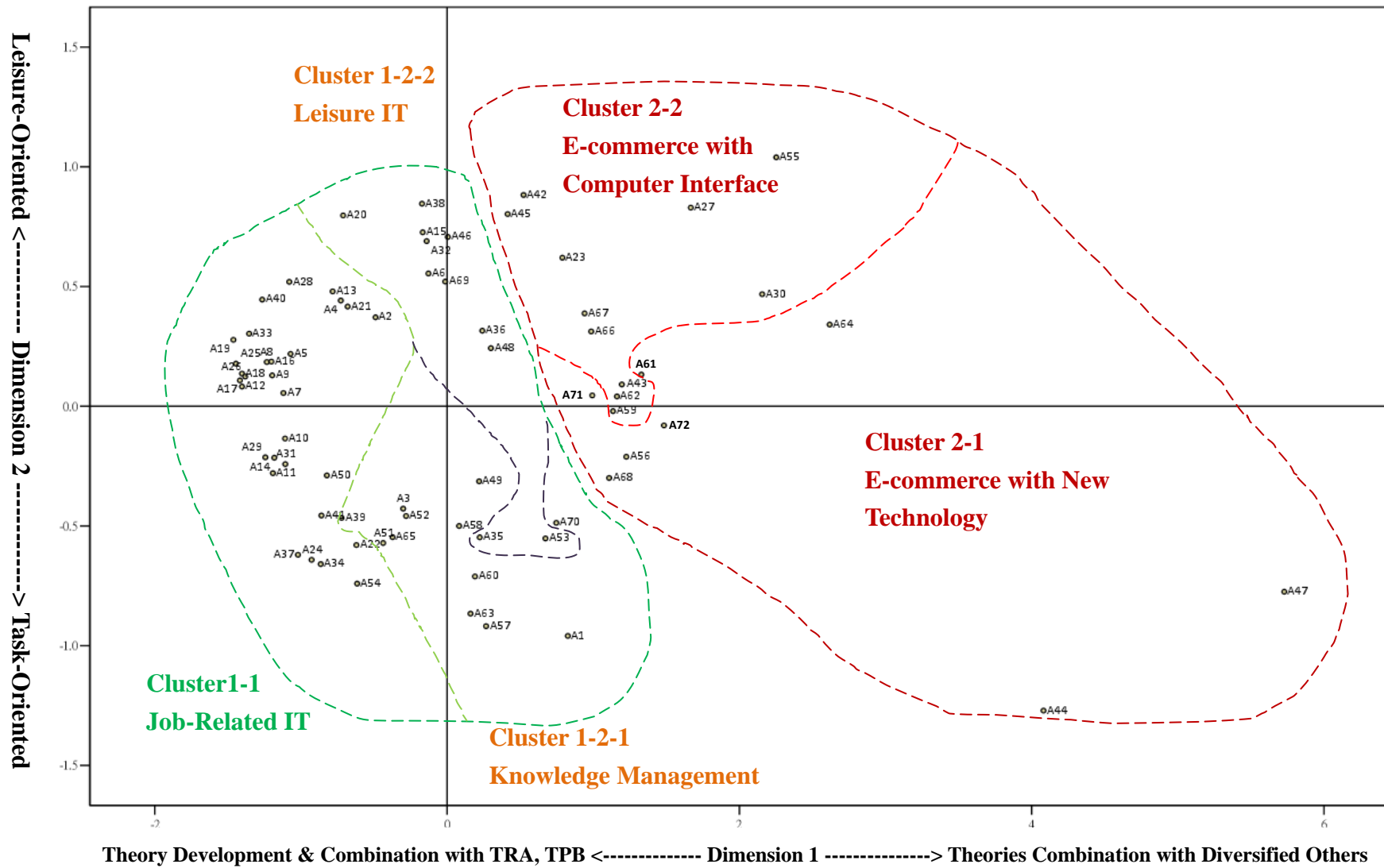
Figure 8　Multidimensional Scaling (MDS)

Dimension 1: Theory Development or Combination with Different Theories

To explain our MDS, interpretation to the dimensions can lead to an understanding of the processes underlying the perceived nearness of objects. Furthermore, it is possible to incorporate individual or group differences in the solution. We mark out five groups based on cluster analysis shown in Figure 7. If we examine the horizontal axis (Dimension 1), we may observe that the research works (Taylor &Todd, 1995 a,b ; Venkatesh, et al., 2003; Chau & Hu, 2001, 2002; Riemenschneider, et al., 2003) located on the left side focus on the TAM development that they attempt to form a robust model with different construct added to examine, and integrate TAM with the theory of reasoned action (TRA)[3] and the theory of planned behavior (TPB)[4], both of which propose good frameworks to describe the relation among human behavior, intention, and attitude.

On the other hand, papers located on the right side also attempt to integrate TAM with various theories or models to make TAM more comprehensive. But the combined theories are others beyond TRA and TPB. For example, the theory of trying (TT), the flow theory, the innovation diffusion theory, the transaction cost analysis (TCA), Service Quality (SERVQUAL), and so on (Bagozzi & Davis; 1992; Koufaris, 2002; Briggs, et al., 2003; Devaraj, wt al., 2002). These combined theories or models provide diversified sets of acceptance determinants toward IT.

With the above discussion, the horizontal axis (dimension 1) can be then interpreted as a "theory development or combination with different theories" dimension – with the polarization of early research on the left side away from current research on the right side.

Dimension 2: Job-oriented or Leisure-oriented

To interpreting the factor related to the vertical axis (dimension 2), aside from cluster 1-1 in which the studies are almost applied in work-related IT context such as word processing applications and spread sheet, most of the studies at the bottom of the vertical axis focus on work-related IT (Davis, 1989; Amoako-Gyampah & Salam, 2004), e-learning (Ong, et al., 2004; Yi & Hwang, 2003), informational web sites

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[3] The theory of reasoned action (TRA) suggests that an individual's behavior is determined by the behavioral intention (BI) to perform the behavior. This provides the accurate prediction of behavior (Chang, 1998). Behavioral intention is a function of one's attitude toward the behavior (A) and subjective norm (SN).
[4] The theory of planned behavior (TPB) extends TRA by adding a construct – perceived behavioral control – to predict behavioral intentions and behavior (Chang, 1998)

(Hong, et al., 2001; Lin & Lu, 2000). These can be classified as job-related and information-acquiring IT usage.

On the contrary, most of the studies at the top of the vertical axis focus on e-commerce (Gefen, et al., 2003; Koufaris, 2002), online banking (Bhattacherjee, 2001), online game (Hsu & Lu, 2004), and leisure websites (van der Heijden, 2004; 2003). These can be interpreted as that the focus of these studies are the non-work-related, voluntary, and leisure IT usage.

With the above discussion, the vertical axis (dimension 2) can be then interpreted as a "job-oriented or leisure-oriented" dimension – with the polarization of job-related IT adoption research on the bottom side away from recreational IT usage research on the top side.

4.4 Discussion

4.4.1 General Discussion

The current research attempts to provide the intellectual development of TAM to identify the dissemination and main trends related within research about this model. Using document co-citation analysis, 72 papers on TAM published in SSCI journals are collected as our core papers to be the basis for three statistical analyses, which are factor analysis, cluster analysis and multidimensional scaling. The results of this study show the presence of our key findings in two major aspects: (1) TAM appliance in different IT context; (2) extended TAM and combination of diversified theories.

On applying TAM in different IT context, researchers have conducted their studies incorporating four main IT categories: (1) job-related IT; (2) information-acquiring IT for knowledge management; (3) leisure IT; and (4) e-commerce.

Observing the relation between the year of publication of core papers in this study and the applied context of IT, it might be induced that the works in early years investigate the adoption of IT which people utilize in the workplace in order to improve work performance. According to Legris' meta-analysis on TAM (2003), he groups these studies under three software tool categories: office automation (e.g. spreadsheet, text-editor, e-mail), software development (e.g. programming tools, software maintenance tools), and business application (e.g. software used in the core 29usiness). To enhance work performance and efficiency are always important issues in business management. Researchers put job-related IT as the first priority to apply in

TAM research. These works are conducted in mandatory settings like work tools. However, as the degree of penetration of personal computers (PC) is getting higher, research trends are gradually transferred to voluntary IT usage context like information-acquiring IT for knowledge management, leisure IT, and e-commerce.

As for information-acquiring IT such as e-learning, digital library, and ERP, the common feature of these media is convenient electronic collections to convey rich content for knowledge management. Knowledge management refers to identifying and leveraging the collective knowledge in an organization (Alavi & Leidner, 2001) or an individual to help build competency. These works have been proven that TAM has been successfully applied to these content-based systems or IT-based systems that are developed to support the organizational or individual processes of knowledge storage, retrieval, transfer, creation, and application (Alavi & Leidner, 2001). Knowledge management is crucial for organizations or individuals as one of the key successful, even survival, factors in today's knowledge-based economy. This shows another main issue in the trends of research of TAM.

Leisure IT includes on-line games, websites providing recreational information, and so on. Leisure IT aims to provide self-fulfilling rather than instrumental value to users (van der Heijden, 2004), and people use them for leisure purpose. The attention on enjoyment and flow experience as people use IT are caught commonly in academic research. Flow experience describes one's action with total involvement. When people are in the flow state, they are absorbed in this activity; their awareness is narrowed into the activity; they even lose their self-consciousness so that they feel in control of the environment. Studies indicate flow experience might occur in gaming, shopping, and so on (Hsu & Lu, 2004). Many TAM researchers put enjoyment or flow experience in the TAM studies as a new construct to examine the influence on users' IT adoption, and they have quite good explanation. The third main trend is revealed.

E-commerce is another important issue emerging with the penetration of PCs and Internet. In this trend, traditional e-commerce (using media with PC interface) and e-commerce with new IT (using media with mobile phone and interactive TV interface) are applied on TAM investigations. As it is mentioned previously, online consumers care about trust and risk of e-commerce because the environment of e-commerce lacks of the typical human interaction which is one of important reasons to lead to trust (Gefen, et al., 2003). This shows that the importance of trust on users' e-commerce adoption.

The current analysis reveals different constructs and theories that have been

combined with TAM in IT adoption research. This is an interesting dissemination. Many researchers attempt to form a comprehensive model to get a better understanding about IT adoption with diverse constructs to attitude, different antecedents toward PU and PEOU, and diversified theories and models to combine with. But the parsimonious TAM, which have merely two variables – PU and PEOU – to influence attitude and then affect IT adoption, is still widely discussed and commonly treated as a solid basis for modification. This shows that TAM is certainly a powerful model to predict and explaining IT usage.

4.4.2 Prediction for Future Research Trend

Reviewing the papers which are published in SSCI journals in management of information system (MIS) with the top three highest impact factors – MIS Quarterly (impact factor: 5.826), Information System Research (impact factor: 2.862), and Information & Management (impact factor : 1.631) after 2006 (Table 12), we found that TAM research in e-commerce context (Kamis, et al, 2008; Xiao & Benbasatis, 2007; Kamis & Stohr, 2006; Ahn et al., 2007; Cyr, et al., 2006; Diney & Hart; 2006) are still popular. New technology adoption is also a popular research topic in TAM. As more and more technology innovation coming, we expect that new technology adoption and e-commerce with new medium will still catch researchers' attention in the future.

Topic	Author	Year	Title	Source	Impact Factor
e-commerce	Kamis, A; Koufaris, M; Stern, T	2008	Using an attribute-based decision support system for user-customized products online: An experimental investigation	MIS Quarterly	5.826
e-commerce	Xiao, B; Benbasat, I	2007	E-commerce product recommendation agents: Use, characteristics, and impact	MIS Quarterly	5.826
e-commerce	Kamis, AA; Stohr, EA	2006	Parametric search engines: What makes them effective when shopping online for differentiated products?	Information & Management	1.631
e-commerce	Ahn, T; Ryu, S; Han, I	2007	The impact of Web quality and playfulness on user acceptance of online retailing	Information & Management	1.631
e-commerce	Cyr, D; Head, M; Ivanov, A	2006	Design aesthetics leading to m-loyalty in mobile commerce	Information & Management	1.631
e-commerce	Diney, T; Hart, P	2006	An extended privacy calculus model for E-commerce transactions	Information Systems Research	2.862
new technology adoption	Castaneda, JA; Munoz-Leiva, F; Luque, T	2007	Web Acceptance Model (WAM): Moderating effects of user experience	Information & Management	1.631
new technology adoption	Kim, SH	2008	Moderating effects of Job Relevance and Experience on mobile wireless technology acceptance: Adoption of a smartphone by individuals	Information & Management	1.631
new technology adoption	Ha, I; Yoon, Y; Choi, M	2007	Determinants of adoption of mobile games under mobile broadband wireless access environment	Information & Management	1.631
new technology adoption	Shin, DH	2009	Determinants of customer acceptance of multi-service network: An implication for IP-based technologies	Information & Management	1.631
new technology adoption	Premkumar, G; Ramamurthy, K; Liu, HN	2008	Internet messaging: An examination of the impact of attitudinal, normative, and control belief systems	Information & Management	1.631
e-learning	Chiu, CM; Wang, ETG	2008	Understanding Web-based learning continuance intention: The role of subjective task value	Information & Management	1.631
ERP	Kwahk, KY; Lee, JN	2008	The role of readiness for change in ERP implementation: Theoretical bases and empirical validation	Information & Management	1.631
meta-analysis	Schepers, J; Wetzels, M	2007	A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects	Information & Management	1.631
meta-analysis	King, WR; He, J	2006	A meta-analysis of the technology acceptance model	Information & Management	1.631
new construct	Karahanna, E; Agarwal, R; Angst, CM	2006	Reconceptualizing compatibility beliefs in technology acceptance research	MIS Quarterly	5.826
new construct	Mao, E; Palvia, P	2008	Exploring the effects of direct experience on IT use: An organizational field study	Information & Management	1.631
new construct	Walczuch, R; Lemmink, J; Streukens, S	2007	The effect of service employees' technology readiness on technology acceptance	Information & Management	1.631
new construct	Burton-Jones, A; Hubona, GS	2006	The mediation of external variables in the technology acceptance model	Information & Management	1.631
new construct	Hasan, B	2006	Delineating the effects of general and system-specific computer self-efficacy beliefs on IS acceptance	Information & Management	1.631
post adoption stage	Saeed, KA; Abdinnour-Helm, S	2008	Examining the effects of information system characteristics and perceived usefulness on post adoption usage of information systems	Information & Management	1.631
theories combination	Pagani, M	2006	Determinants of adoption of High Speed Data Services in the business, market: Evidence for a combined technology acceptance model with task technology fit model	Information & Management	1.631

Table 13   Papers Published After 2006 in Major Journals

V. Conclusions and Limitations

In this study, we investigate the dissemination on technology acceptance model with document co-citation analysis of the inductive bibliometrical method. After factor analysis, cluster analysis and multidimensional scaling, the current study represents the following dissemination: (1) TAM appliance in different IT context; (2) extended TAM and combination of diversified theories. Four major groups of IT context are applied in: (1) job-related IT; (2) information-acquiring IT for knowledge management; (3) leisure IT; and (4) e-commerce. With the historical diffusion of TAM, we suggest studies on e-commerce with emerging media and new technology adoption are still popular in the future. With the above research results, some ideas could be brought to further research on TAM to make this research more complete.

Though several important dissemination and trends on TAM are revealed using document co-citation method, some limitations resulting from this co-citation method are hard to avoid (Nerur, et al., 2008.). Firstly, all citations are treated alike when they may be cited according to different reasons, ranging from a reference to support one's work to a retort to criticism. Secondly, the process of selection of core papers is unavoidably somewhat subjective like that Davis' article (1989) is added into the set of core papers because it is considered as an important and famous research work on TAM, but this work cannot be found through key-word search. This might diminish the objectivity of which the co-citation method is proud. However, despite of these limitations, the value for reference from our results does not detract. Further research could keep tracks on the dissemination on TAM research in the future to prove this study or improve our results.

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