

行政院國家科學委員會專題研究計畫 成果報告

企業資源規劃系統的關鍵成功因素,系統評選以及使用者採用情形之研究 研究成果報告(精簡版)

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行政院國家科學委員會補助專題研究計畫 成果報告

企業資源規劃系統的關鍵成功因素、系統評估以及使用者採用情形之研究 Investigation of critical success factors, system evaluation and usage adoption for enterprise resource planning system

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計畫主持人：施雅月 中華大學 資訊管理系

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摘要

近年來，很多企業藉由企業資源規劃(Enterprise resource planning; ERP)系統的導入來整合內部組織的運作效能，進而達到降低營運成本、提升產品和服務品質以及企業的競爭優勢。然而，對於中、小型企業而言，在評估企業資源規劃系統導入時所必須面對的挑戰(如高成本的壓力、高失敗率等)，比起大型企業要來的艱鉅許多。再者，由於影響企業選擇企業資源規劃系統的因素很多，且多半不易量化，容易因為決策者的主觀判斷而增加企業建置系統的困難度。因此，不論對於企業或是對於研究學者而言，能夠事前瞭解影響ERP系統導入成敗的關鍵因素以及在供應商選擇時能具有系統性的評選流程，進而在系統導入時能夠充份了解公司內部的使用者對於該系統的接受情形，藉此降低使用者的抗拒以利於系統的成功推導就成為重要的課題之一。本研究計畫的成果主要在於藉由納入電腦自我效能、電腦焦慮以及高階主管支持等變數後的擴展式科技接受模式來解釋使用者的採用情形。

關鍵字：企業資源規劃、電腦自我效能、電腦焦慮、高階主管支持

Abstract

Many companies have recently employed enterprise resource planning (ERP)

systems to integrate operational efficiency, thus reducing costs, while enhancing service quality and competitive advantages. However, small enterprises find it extremely difficult to develop a method of evaluating ERP systems. Furthermore, while many other factors relate to the best method of selecting a useful ERP system, it is difficult to measure these factors. Therefore, it is worthwhile examining the many factors that govern the success or failure of implementation, proposing a systematic procedure to select ERP system and even to know the actual usage in following implementation. One of the research directions is to incorporate additional behavioral constructs, computer self-efficacy, the antecedent of CSE and computer anxiety, top management support to original TAM model. The aim is to explain behavioral intention and actual usage of ERP implementation.

Keywords: Enterprise resource planning, computer self-efficacy, computer anxiety, top management support

1. Introduction

Minimizing the cost and maximizing the profit are the necessary to enhance competitive advantage, and implementing

ERP system is one means of achieving these objectives. An enterprise resource planning (ERP) system is a packaged business software system that provides a totally integrated solution for organizational information-processing needs, efficiently and effectively manage resources (materials, human resources, finances, etc.) (Shih, 2006). Implementing an enterprise resource planning system generally is expensive and risky, and thus researchers and companies have been trying to find factors that influence the information system success. In fact, as described by Amoako-Gyampah and Salam (2004), numerous factors influence information system success, especially individual acceptance or resistance. In this area, technology acceptance model (TAM; Davis, 1989) is one of the most widely used models for explaining the behavioral intention and actual usage, and can improve our understanding of how influence on actual usage should help increase the probability of successful ERP implementation.

Two particular beliefs, namely perceived usefulness (PU) and perceived ease of use (PEOU), are crucial in the TAM for predicting information technology user acceptance behavior. Besides, recent empirical studies have also focused on explaining the influence of external variables on user beliefs regarding ERP systems (e.g., Amoako-Gyampah and Salam, 2004; Shih, 2006; Amoako-Gyampah, 2007). Amoako-Gyampah (2007) examined the influence of perceived usefulness, user involvement, argument for change, prior usage and ease of use ERP system usage

intention. According to Amoako-Gyampah, users perception of usefulness, ease of use of the technology, and the users' level of intrinsic involvement all affect their intention to use the technology. Shih (2006) also incorporates computer self-efficacy into TAM to improve the predictive value of the original TAM mode.

Moreover, although some studies have considered different external variables, they have only adopted the perspective of individuals. In fact, organizational factors, such as top management support may significantly impact actual usage of ERP implementation. This study thus built upon previous research by incorporating the determinant of top management support as the external factor affecting computer self-efficacy, computer anxiety, perceived ease of use, perceived usefulness and actual usage of ERP implementation. This study also used structural equation modeling to assess overall model fit and verify the causal relationships between variables.

2. Related work

2.1 Prior research on ERP system

Recently, three review articles comprised all the prior research on ERP. The first is Esteves and Pastor (2001), who briefly summarized each journal and conference article and also provided a complete list of references during the 1997-2000. Second, Botta-Genoulaz et al. (2005) analyzed the literature for the years 2003 and 2004 to classify ERP systems research into six categories: ERP implementation, ERP

optimization, ERP management, ERP software, ERP in supply chain management and case studies. Moon (2007) also conducted a review of work published in various journals on Enterprise Resource Planning (ERP) between January 2000 and May 2006. Her research aimed to understand the questions addressed by ERP, and six major themes were ERP implementation, using, extension, value, trends, and educations.

Moon (2007) demonstrated that most relevant articles (approximately 40% of the total) belong to this theme. For example, Amoako-Gyampah and Salam (2004) evaluated the impact of one belief construct (shared beliefs in the benefits of a technology) and two widely recognized technology implementation success factors (training and communication) on PU and PEOU. The analytical results demonstrated that both training and project communication influence shared user beliefs regarding the benefits of the technology and also that the shared beliefs influence the PU and PEOU of the technology. Lander et al. (2004) consider trust-building mechanism between team members and other actors of the project as major implementation issues. Moreover, Shih (2006) examines ERP system user usage behavior via the extended technology acceptance model with the incorporation of computer self-efficacy.

2.2 Technology acceptance model

The Theory of Reasoned Action (TRA) of Fishbein and Ajzen's (1975) and the Technology Acceptance Model (TAM) of Davis's (1989) provide a theoretical means of

measuring beliefs and attitudes for predicting future behavior patterns. The TAM was adapted from the TRA and provided a basis for previous research on IS dealing with IT related behavioral intentions and usage (e.g., Davis et al., 1989). Two particular beliefs, perceived usefulness (PU) and perceived ease of use (PEOU), are crucial in the TAM for predicting information technology user acceptance behavior. Davis (1989) defined PU as "the degree to which individuals believe that using a particular system can enhance their job performance", and defined PEOU as "the degree to which individual believe that using a particular system will be effortless. TAM postulated that computer usage is determined by behavioral intention to use a system, while system usage intention is jointly determined by individual attitude towards system use and individual perceptions of its usefulness.

2.2 Computer self-efficacy

Bandura (1977) identified self-efficacy as relating to individual beliefs in their ability to perform a task, and is expected to influence task effort, persistence, expressed interest, and the level of goal difficulty selected for performance (Gist, 1987). Generally, individuals with high efficacy expectations are more likely to succeed in a given task (Oliver and Shapiro, 1993). Wood and Bandura (1989) indicated that high self-efficacy individuals work harder and longer than low self-efficacy individuals. Researchers have frequently found that performance improves with the self-efficacy level (Bandura et al., 1982).

Consequently, different types of self-efficacy are emerged from Bandura's research, such as computer self-efficacy (Compeau and Higgins, 1995) and Internet self-efficacy (Torkzadeh and van Dyke, 2001). Computer self-efficacy is defined by Compeau and Higgins (1995) as individual judgments regarding their computer skills. Computer self-efficacy is significant in the use of systems and even in helping individuals more easily acquire many of the skills associated with effective computer use. For example Venkatesh and Davis (2000) modeled and empirically tested the determinants of PEOU and found that individual computer self-efficacy is a strong determinant of PEOU, while objective

usability influences ease of use only after direct experience with the system. Furthermore, Venkatesh and Davis (2000) implied that a training mechanism designed to improve user computer self-efficacy is more likely to gain user acceptance.

3. Proposed model --research model and hypothesizes

Figure 1 shows the constructs and hypothesized links in the proposed model. This section presents theoretical arguments supporting the proposed paths, and subsequently present data from structural equation modeling to support these relationships. The area within the dotted line denotes the original TAM.

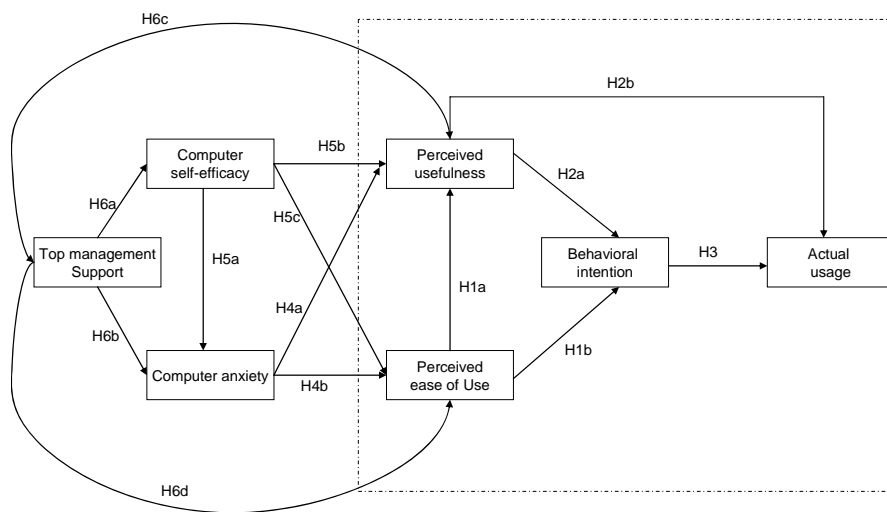


Figure 1: The determinants and consequences of the proposed model.

4. Research design

4.1 Measurement

The published items related to attitude to use, perceived ease of use, and perceived usefulness (Davis, 1989) were used directly and with only minor changes to reflect the application of the system in the world. Furthermore, revised items were adopted

from Shih (2006). This study separately assesses two measures of actual system use: the first is usage volume and refers to the number of hours per week a respondent reports using the ERP system, while the second, usage frequency, indicates reported weekly usage.

A ten-item measure of computer self-efficacy was adopted from Compeau and Higgins (1995) for measuring individual perceptions of their ability to use a computer to accomplish an ERP task. Individual were asked to indicate the extent of agreement or disagreement with the following statements concerning ERP system on a 5-point scale ranging from (1) strongly disagree to (5) strongly agree. Top management support was assessed via six items asking respondents to indicate the degree of top management encouragement and resources allocation. The measure of top management support was developed by Igarria (1990). The measure comprised six statements on a 5-point scale ranging from (1) strongly disagree to (5) strongly agree are used. The measures of computer anxiety were developed by Brown and Town (2002). Four-item scales were used to measure computer anxiety, the response options were anchored on a 5-point Likert-type scale, ranging from (1) strongly disagree to (5) strongly agree. Lower score indicated lower level of computer anxiety.

4.2 Data collection

The study samples are either implemented or the ERP system is used. Respondents were phoned in advance with interview requests, after which an interview, and then an interview format was used to record their responses. A total of 165 useable responses were obtained, with no missing date. 65% of the respondents belonged to manufacturing industry, the remainders were information and service industry. Moreover, all respondents had experience of using ERP

software, with 99% claiming at least 12 months of such experience.

5. Analysis results

5.3 Analytical results of the proposed model

The fit statistics indicate that the TAM model provides a good fit to the data ($\chi^2_{560} = 745.35$, $p < 0.001$; Norm Chi-square=1.33; CFI=0.92; NNFI=0.90; RMSEA = 0.051). In terms of predictive power, the variance in all four dependent variables (R^2_{BI} , R^2_{Usage} , R^2_{PU} , R^2_{PEOU} , R^2_{SE} and $R^2_{Anxiety}$) of the proposed model equals 0.41, 0.25, 0.54, 0.86, 0.32 and 0.33, respectively. The path coefficients are shown in figure 2, which are as hypothesized in each case ($p < 0.05$ in all instances).

The analytical result is consistent with Hypothesis 1b, perceived ease of use had a strong direct effect on behavioral intention. Furthermore, in accordance with Hypothesis 2a, perceived usefulness significantly and directly affected behavioral intention ($\beta = 0.4$, $p \leq 0.001$). Hypothesis 2b that the relation between perceived usefulness and actual usage was not supported. Finally, consistent with H3, behavioral intention had directly affect actual usage ($\beta = 0.35$, $p \leq 0.001$). The analytical results also demonstrates that 41% of the variance of behavioral intention was explained by all antecedent variables and 25% of the variance of actual usage was explained by the model.

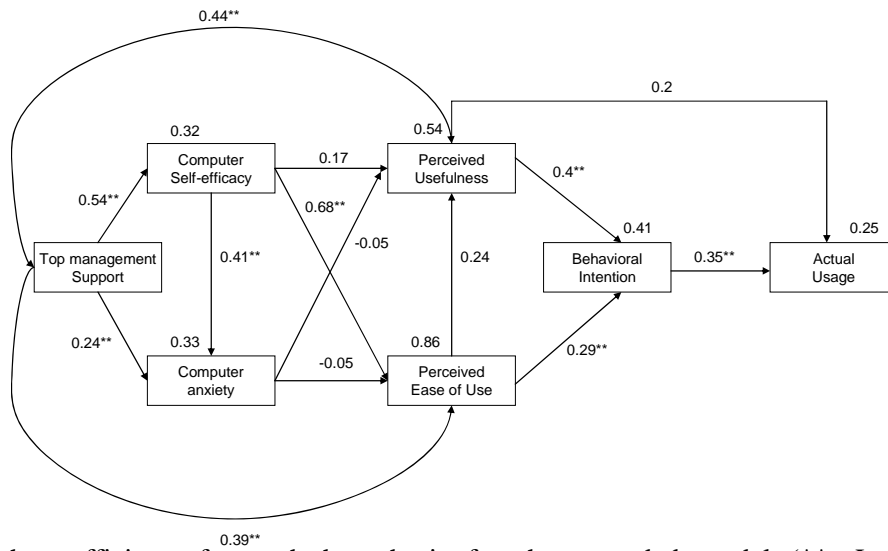


Fig. 2: Path coefficients for each hypothesis for the extended model (**: Level of significance = 0.01)

Computer anxiety, consistent with Hypotheses 4a and 4b did not significantly impact perceived usefulness and perceived ease of use. Computer self-efficacy is inconsistent with Hypothesis 5b strongly and directly affected perceived usefulness ($\beta=0.17$, $p \leq 0.001$). Top management support as hypothesized by Hypothesis 6c and 6d, strongly directly and indirectly affected perceived usefulness and perceived ease of use, respectively. Furthermore, consistent with Hypothesis 5c, computer self-efficacy had a strong direct effect on perceived ease of use. Inconsistent with Hypothesis 1a, perceived ease of use did not influence perceived usefulness.

That top management support explained 32% of the variance and significantly and directly affected computer self-efficacy (Hypothesis 6a; $\gamma=0.55$, $p \leq 0.001$). This is inconsistent with Hypotheses 6b, that top management support did not significantly influence computer anxiety. In accordance with Hypothesis 5a, self-efficacy was also

found to insignificantly affect computer anxiety.

6. Conclusion and discussions

Improving understanding of how influence on actual usage can help increase the probability of successful ERP implementation, and this work extended previous research by incorporating the determinant of top management support as the external factor influencing computer self-efficacy, computer anxiety, perceived ease of use, perceived usefulness and actual usage of ERP implementation. Furthermore, this study also employed structural equation modeling to assess overall model fit to verify the causal relationships between variables.

According to Igarria and Iivari (1995), as individuals possess more resources to help them become proficient, their worries about using computers, including nervousness, unease, discomfort, or scare, are dissipated. However, in this case, top management support was insignificantly and negatively impacted computer anxiety, but in fact, as

Igbaria and Iivari (1995) stated that computer anxiety is probably caused by low self-efficacy. Furthermore, computer anxiety is not significantly negatively related to perceived usefulness and perceived ease of use, inconsistent with the research of Brown and Town (2002) and Venkatesh (2000). In this study, we found that means of four-items of computer anxiety were less than 2, and thus represented that they don't agree that they were anxiety when working with computer. That might be the possible reason why these hypotheses were not supported in this study.

The implications for researchers and practitioners, an extended version of TAM was proposed to improve the explanatory power of ERP implementation. For example, compared to the research of Shih (2006), the r-square of perceived usefulness and perceived ease of use were improved to the levels of 0.54 and 0.86, respectively, representing that top management support has highly contribution to the model. Similar to previous studies (e.g., Somers and Nelson, 2001), top management support was critical to ERP success.

6. Project evaluation

From the study of critical success factors to system evaluations and ERP adoption, we have accomplished 90% of the work described in the proposal. In summary, we have proposed an overall perspective from different stage of ERP implementation. Furthermore, our work will be a basis for further research on ERP issues.

Reference

1. Amoako-Gyampah, K. (2007), Perceived usefulness, user involvement and behavioral intention: an empirical study of ERP implementation, *Computers in Human Behavior*, 23, pp. 1232-1248.
2. Amoako-Gyampah, K., and Salam, A.F. (2004), An extension of the technology acceptance model in an ERP implementation environment, *Information & Management*, 41(6), pp. 731-745.
3. Bandura, A. (1977), Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, 84 (2), pp. 191-215.
4. Bandura, A. (1982), Self-efficacy mechanism in human agency *American Psychologist*, 37, pp. 122-147.
5. Botta-Genoulaz, V., Millet, P.A., and Grabot, B. (2005), A survey on the recent research literature on ERP systems, *Computers in Industry*, 56, pp. 510-522.
6. Brown, Irwin T.J., and Town C. (2002), Individual and technological factors affecting perceived ease of use of Web-based learning technologies in a developing country, *The Electronic Journal on Information Systems in Developing Country*, 9(5), pp. 1-15.
7. Compeau, D.R., and Higgins, C.A. (1995), computer self-efficacy: development of a measure and initial test, *MIS Quarterly*, 19, pp. 189-211.
8. Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989), User acceptance of computer technology: A comparison of two theoretical models, *Management Science*, 35, 982-1003.

9. Davis, F.D. (1989), Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, 13(3), pp. 319-339.
10. Esteves, J., and Pastor, J. (2001), Enterprise resource planning systems research: an annotated bibliography, *Communications of the Association of Information Systems*, 7, pp. 1-52.
11. Fishbein, M.A., and Ajzen, I. (1975), *Belief, attitude, intention and behavior: an introduction to theory and research*. Reading MA: Addison-Wesley.
12. Gist, M.E. (1987), Self-efficacy: implications for organizational behavioral and human resource management. *Academic Management Review*, 12, pp. 472-485.
13. Igarria, M. (1990), End-user computing effectiveness: a structural equation model. *Omega*, 18, pp. 637-752.
14. Igarria, M., and Iivari, J. (1995), The effects of self-efficacy on computer usage, *Omega*, 23(6), pp. 587-605.
15. Lander, M.C., Purvis, R.L., McCray, G.E., and Leigh, W. (2004), Trust building mechanisms utilized in outsourced IS development projects: a case study, *Information & Management*, 41(4), pp. 509-528.
16. Moon, Y.B. (2007), Enterprise Resource Planning (ERP): a review of the literature, *International Journal of Management and Enterprise Development*, 4(3), pp. 235-264.
17. Oliver, T. A., and Shapiro, F., 1993. Self-efficacy and computers. *Journal of Computer-Based Interactions*, 20, pp. 81-85.
18. Shih, Y.Y. (2006), The effect of computer self-efficacy on enterprise resource planning usage, *Behaviour & Information Technology*, 25(5), pp. 407-411.
19. Somers, T.M., and Nelson, K. (2001), The impact of critical success factors across the stages of enterprise resource planning implementation, In *Proceedings of the 34th Hawaii international conference on systems sciences (HICSS-34)*, Maui, Hawaii.
20. Torkezadeh, G., and van Dyke, T.P. (2001), Development and validation of an Internet self-efficacy scale. *Behaviour & Information Technology*, 20(4), pp. 275-280.
21. Venkatesh, V. (2000), Determinants of perceived ease of use: integrating control, intrinsic motivation and emotion into the technology acceptance model, *Information Systems Research*, 11(4), pp. 342-365.
22. Venkatesh, V., and Davis, F.D. (2000), A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, 46(2), pp. 186-204.
23. Wood, R.E., and Bandura, A. (1989), *Social cognitive theory of organizational management*, *Academy of Management Review*, 14, pp. 361-384.

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會議的報告內容

今年度很榮幸有機會受邀參加 2008 Hawaii International Conference on Business 今年於美國夏威夷舉辦，共計將近 400 位的參與者有來自全球 40 個國家，這些國家包括 Australia, Bangladesh, Canada, China, Czech Republic, Denmark, Egypt, Finland, France, Germany, Ghana, Greece, Hong Kong, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kingdom of Saudi Arabia, Macau 等，會議時間為 2008 年 5 月 22 日至 25 日，地點為美國夏威夷的 Waikiki Beach Marriott Resort & Spa，其接受之論文主題以商業、電子商務與資訊技術為主，包括：Accounting、Business Administration、Business Policy and Strategy、Economics、Electronic Commerce、Entrepreneurship、Financial and Banking、Health Care Administration、Human Resource、Information System and Technology 等。

由於發表之論文主題屬於電子商務，故歸類在管理資訊系統中。本篇論文被安排在 5 月 22 日下午 2：40 至 14：10 的 Session 場次，是以，此次與會安排之行程為 5 月 21 日下午搭機赴美國夏威夷，22 日早上至會場參加其他場次之論文發表，下午發表論文，25 日下午搭機返台。此次自己發表論文主題：An extended technology acceptance model with information and system quality perspective。

在本次的與會人士中，多數是歐亞地區的學者，而且有些教授學者在學術上很活躍。除了更能與他們分享研究成果之外，也能夠增加吸取相關領域的研究內容。

本研討會主要係以商業、電子商務與資訊技術為主，如有與大會二十多個主題類組相符者，請儘早準備，以免準備不及。所以，有興趣參加者，請注意投稿時間，約 2 月底前送交英文摘要初審，3 月底前送交論文英文全文，2009 年的會議將同樣在原場地舉行。

在此，感謝國科會對本人出席國際會議時所給予的經費補助 (NSC-96-2416-H-216-003)，我希望未來有更多出席國際研討會的機會，除了更能與學者分享研究成果之外，也能夠增加吸取相關領域的研究議題。

施雅月