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The intellectual development of the technology acceptance model: A co-citation analysis

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ABSTRACT

The goal of this paper is to present a visual mapping of intellectual structure in two-dimensions and to identify the subfields of the technology acceptance model through co-citation analysis. All the citation documents are included in the ISI Web of Knowledge database between 1989 and 2006. By using a sequence of statistical analyses including factor analysis, multidimensional scaling, and cluster analysis, we identified three main trends: task-related systems, e-commerce systems, and hedonic systems. The findings yielded managerial implications for both academic and practical issues.

1. Introduction

The investments in information systems (IS) for today's organizations have expanded dramatically, accounting for about 50% of new capital investment (Venkatesh, Morris, Davis, & Davis, 2003). Despite the considerable investments in IS, about 74% of IS and software engineering projects are delayed, exceed budget, and fail to meet the functional expectations (Schepers & Wetzels, 2007). Therefore, identifying influential factors on technology acceptance across different settings have been an important and focal interest in IS for both researchers and practitioners.

Among numerous theories, the technology acceptance model (TAM) was considered to be the most influential and valid model for describing an individual's acceptance of information systems (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). Two specific behavioral beliefs – perceived ease of use (PE) and perceived usefulness (PU) – determine an individual's behavioral intention to use (BI) a technology. Derived from the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) which posits that human behavioral intention is affected by attitude and subjective norm, TAM is specialized for the use of information systems.

In the early stages, information systems were designed to improve task performance and efficiency. Those job-related information systems can be categorized as automation software (e.g., spreadsheet, text-editor), office systems (e.g., word processor, spreadsheet, database programs), system developments (e.g., programming tools, software maintenance tools), and communication systems (e.g., e-mail, voice mail, mobile phone, face-to-face meeting) (Legris, Ingham, & Collerette, 2003; Lim, Lee, & Nam, 2007). The rapidly increasing tendency of Internet usage and worldwide e-commerce has led researchers to work on the general topic of e-commerce (Gefen, Karahanna, & Straub, 2003b; Heinze & Hu, 2006; Lin, 2006; Morgan & Hunt, 1994). Major theoretical and empirical studies have attempted to identify influential factors such as trust and other innovation factors in attracting web users and in consuming products via websites (Venkatraman & MacInnis, 1985; Yiu, Grant, & Edgar, 2007). Therefore, perceived usefulness (PU) and perceived ease of use (PE) may not fully explain the Internet users' motives, as Davis (1989) argued that research studies on any new IT acceptance need to address how other variables affect PU, PE, and the end users' acceptance.

The popularity of TAM research studies can be found from journal citations in the ISI Web of Knowledge database whereby Davis's (1989) article received 424 journal citations by the beginning of 2000, 698 journal citations by 2003, and currently nearly 2000 journal citations. Even though literature reviews and meta-analyses have been conducted to test the convergence of TAM relationships across difference settings and provide an objective statement in TAM (King & He, 2006; Schepers & Wetzels, 2007), previous researches have not yet answered the following addressed questions: what intellectual subfields have emerged from TAM research? In which reference disciplines are these subfields grounded? To what extent do these subfields represent active areas of current research? Additionally, what are the emerging research areas in TAM?

To answer the above questions, bibliometrics, a mathematical and statistical analysis, was used to detect the homogeneous areas

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in research networks and to assess the movement and interactions within and between fields (Small, 1973; Sugimoto, Pratt, & Hauser, 2008; White & Griffith, 1981; Zitt & Bassecoulard, 1996). One of the best-known structuring methods of bibliometrics is co-citation analysis (Borgman, 1989).

A co-citation analysis was used to interpret the similarity of content between two documents by counting the number of documents which have been cited in a pair (Garfield, 1979; Small, 1973). Its premise is that bibliographic references of a scientific paper are often considered to be important in the development of research and signal their influences, so they can serve as the theoretical and empirical foundations of the study (Ramos-Rodriguez & Ruiz-Navarro, 2004). Therefore, it is possible to identify networks of authors or documents belonging to the same discipline or field by analyzing the references. More elaborately, frequently cited documents are likely to have a greater influence on the discipline than those less cited (Culnan, 1986). If two documents are frequently jointly cited, then they are likely to share similar or related concepts (White & Griffith, 1981). By counting and analyzing the frequency of two documents or authors cited in the same work, we can identify groups of closely related documents which address the same research questions (Price & De Solla, 1965; Small, 1973).

The goals of this paper are in line with the co-citation method: (1) identify the subfields within TAM; (2) analyze the relational links between the subfields; (3) graphically map the intellectual structure in a two-dimensional space; and (4) recognize the main trends within TAM. To the best of our knowledge, this paper is the first to apply bibliometric techniques in the field of TAM. Therefore, the major contribution of this paper is to provide an intellectual structure and trends within the field of TAM from an objective and quantitative perspective.

2. Literature review

In order to document the current subfields and the emergence of new research areas in TAM, this section reviews both the general TAM literature and literature on co-citation analysis.

2.1. Technology acceptance model

Information technology (IT) offers a great opportunity to improve job performance; however, the benefits gained from it often depend on the users' willingness to accept and use these available systems. Various theories have been presented to investigate factors affecting an individual's acceptance toward a new information system. Among those studies, the technology acceptance model (TAM) has received considerable attention in the information systems (IS) field and has been tested and extended by many researchers who specialize in IS usage (Mathieson, Peacock, & Chin, 2001). It was developed from the social psychology Theory of Reasoned Action (TRA) which posited that human behavioral intention is affected by attitude and subjective norm (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The original TAM did not include subjective norm. However, Venkatesh and Davis (2000) found that it influences both perceived usefulness and intention after conducting four longitudinal field studies, so they included the subjective norm into TAM2.

The technology acceptance model (TAM) explains user acceptance of a technology based on user perceptions (Davis, 1989; Davis et al., 1989). The mediating roles of perceived usefulness (PU) and perceived ease of use (PE) are examined in the relationship between external variables and the intention of system usage. While PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance," PE is defined as "the degree to which using the technology will be free of effort" (Davis, 1986, 1989). Both PU and PE influence the individual's attitude toward using an information system. Attitude and PU, in turn, predict the individual's behavioral intention to use it. Among these beliefs, PE is hypothesized as a predictor of PU (see Fig. 1).

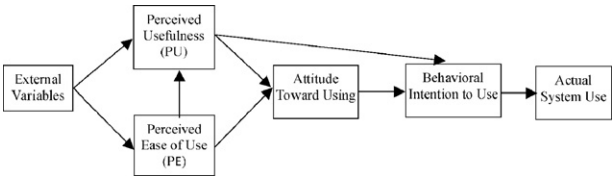

Fig. 1. Original technology acceptance model (Davis et al., 1989).

IS research has long focused on how and why individuals adopt new information technologies. Since the mid-eighties, IS researchers have concentrated their efforts in developing and testing models that could help to predict system use (Chau, 1996; Cheney, Mann, & Amoroso, 1986). Among which, TAM has been widely recognized as a robust, powerful, and economical model for predicting the acceptance of information technology. However, after conducting a review of 22 articles according to some criteria from six MIS leading journals between 1980 and 2001, Legris et al. (2003) presented that either TAM or TAM2 explains only 40% of system use. This indicates that there are other significant factors affecting PU, PE, and user intention of new technology. Nevertheless, results from two recent meta-analysis studies still show that TAM is a valid and robust model with wide application under various conditions such as user types, usage types, or types of information systems (King & He, 2006; Schepers & Wetzels, 2007).

Recently, TAM research studies have turned into an important issue – moderating effects, because by including moderators, the limited explanatory power of TAM can be enhanced and the inconsistent relationships among studies can be solved (Sun & Zhang, 2006; Venkatesh et al., 2003). For example, King and He (2006) conducted a meta-analysis examining the moderating effects of user types and usage types. The results show that Internet usage was different from other types of usage such as task applications, general use (such as e-mail and telecommunication), and office applications. Schepers and Wetzels (2007) discussed three types of moderators: individual-related factors (types of respondents), technology-related factors (types of technology), and contingent factors (culture). Their results confirmed the roles of all moderators especially with the significant influence of subjective norm on perceived usefulness and behavioral intention to use. Therefore, other moderation variables, such as age, experience, personal innovativeness, or computer self-efficacy, are suggested for further investigation.

2.2. Co-citation analysis

In this study we intend to identify the subfields characterized by the intellectual nature of specialties and the main trends within TAM. Co-citation analysis can provide an objective and quantitative means to meet our goals. There are different levels of co-citation analysis: document co-citation analysis, author co-citation analysis (ACA), and journal co-citation analysis. Small (1973) introduced document co-citation analysis by evaluating the network created when documents are linked according to their joint citations by subsequent documents. Author co-citation analysis, by contrast, uses authors instead of documents to produce maps of prominent authors within a selected field by means of computational and graphic display techniques (White, 1990; White & Griffith, 1981). McCain (1991a, 1991b) introduced journal co-citation analysis, which treats representative journals of each field as the units