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# Examining ERP Committee Beliefs: A Comparison of Alternative Models

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# EXAMINING ERP COMMITTEE BELIEFS:

## A COMPARISON OF ALTERNATIVE MODELS

### *Examiner les croyances du Comité PGI : Une Comparaison des Modèles Alternatifs*

*Completed Research Paper*

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### **Abstract**

*Various models have been proposed to explain information technology (IT) adoption behavior. However, these models are based primarily on logical deliberation. In reality, it is impossible to obtain perfect information for a rational evaluation of new or emerging IT. In this situation, sometimes the “best alternative” is imitation. We believe that two opposing forces influence the beliefs of enterprise resource planning (ERP) committee members: rational and imitative. We propose here an integrated model and examine it together with diffusion of innovation (DOI) and imitation models. The study findings indicate that our integrated model has better explanatory power. In addition, imitative forces are shown to have a consistent direct effect and significant indirect effect on beliefs. Hence, imitative forces play a crucial role in the decision-making process, which opens up a new avenue for research into technology adoption.*

**Keywords:** technology adoption, imitation, enterprise resource planning (ERP), technology acceptance model.

## **Résumé**

*Les décisions d'adoption peuvent relever de logiques rationnelles ou d'imitation. Nous proposons ici un modèle intégré d'adoption des TIC et montrons qu'il possède un meilleur pouvoir explicatif que les modèles de diffusion de l'innovation et d'imitation. De plus, les forces imitatives ont un effet direct et indirect significatif sur les croyances des équipes dans les projets ERP. Les forces imitatives jouent donc un rôle crucial dans le processus décisionnel, ouvrant un nouvel horizon pour la recherche sur l'adoption des TIC.*

## **Introduction**

In the last two decades, various well-tested approaches, including the technology adoption model (TAM) (Davis 1989), diffusion of innovation (DOI) theory (Rogers 2003), theory of reasoned action (TRA) (Fishbein and Ajzen 1975) theory of planned behavior (TPB) (Ajzen 1985), and the Triandis model (Triandis 1980), have been applied to explain information technology (IT) adoption behavior. Many researchers (see, e.g., Chau (1996); Mathieson et al. (1998); Venkatesh and Davis (2000)) have attempted to expand and/or modify the original models to make them more theoretically complete. However, by nature of their assumption – that all adoption processes are systematically conducted and follow a rational path – these models still focus primarily on logical deliberation. The aforementioned theories propose that beliefs drive IT adoption because they influence an individual's overall attitude toward a specific IT, which, in turn, guides the individual's intention to adopt the technology. Subsequently, intention is translated into an action that causes the individual to either adopt or not adopt that IT. It is assumed in this logical, psychological evaluation process that a person or an organization has a complete picture of the situation and is able to anticipate the consequences that will follow each choice (March, 1981, Simon, 1997); thus, they represent the rational and logical process of IT evaluation for optimal IT adoption decisions. However, these theories are able to describe only a portion of adoption behavior, and it is well known that many IT adoption initiatives fail, with millions of dollars wasted in the process (Liang et al., 2007, Xue et al., 2005). Apparently, current theories are inadequate to explain and evaluate IT adoption. Their inadequacy may possibly be due to their emphasis on the logical side of IT evaluation behavior and neglect of the illogical side of adoption behavior.

In reality, it is impossible to obtain perfect information for a rational evaluation of new or emerging IT. Awareness of the lack of perfect information results in uncertainty. When uncertainty occurs in the IT adoption process, the logic sequence fails as it is not possible to anticipate the consequences and select the best alternative accordingly. In situations of uncertainty, sometimes the “best alternative” may not be the direct result of logical deliberation as described in the various adoption models; rather, we may turn to a different approach – imitation. Imitation occurs not only on an individual but also on an organizational level. DiMaggio and Powell (1983) argue that initial adoption of innovation is caused largely by the desire to improve performance. However, as the innovation gains popularity, a threshold is reached, and beyond that, adoption of the innovation becomes a pursuit for legitimacy rather than a necessity. From this perspective, imitation can also be regarded as an optimal response to a particular type of uncertainty (Casson, 1997).

In view of the above discussion, we believe that there are two opposing forces influencing the beliefs of an individual or organization when IT adoption decisions are being made: rational and imitative forces. These two forces, along with their interactions, may have an even greater influence in the case of the adoption of enterprise systems, which have a profound impact on the adopting companies. Of these systems, enterprise resource planning (ERP) systems have been most widely researched and adopted. An ERP system is a business support system that maintains in a single database the data needed for a variety of business functions, such as manufacturing, supply chain, financial, project, human resource, and customer relationship management. Research studies have identified a wide range of antecedents of ERP adoption, ranging from perceived enjoyment (Hackbarth et al. 2003), perceived ease of use (Hackbarth et al. 2003) and perceived usefulness (Gefen 2004) to uncertainty avoidance (Hwang 2005). Not surprisingly, these studies only addressed the socio-technical variables critical to ERP adoption. Illogical forces that may impact ERP adoption still remain unattended.

In the last decade, companies are increasingly utilizing ERP systems because these systems are believed to be effective in reducing costs and increasing profit margins (Shore, 2006). In practice, however, assimilation of an ERP system is complex, and ERP success is even harder to achieve (Zhang et al., 2005). Often, a steering committee, which includes representatives from many departments and functional groups, will be formed to gain a better understanding of the constraints and requirements of the company in adopting an ERP system. The beliefs of these

committee members about the system then affect their subsequent psychological states and adoption behavior, as theorized in TRA, TPB, TAM, DOI, and other adoption models. Hence, the forces that shape such beliefs, which can be manipulated through various interventions (Walsh 1988), must be investigated.

A belief about ERP is the subjective psychological state regarding the potential of ERP (Liang et al. 2007). Belief has been an underlying theme among many popular models in the information system (IS) field even though these models diverge widely in their objectives and focuses (Agarwal and Karahanna 2000). However, research into belief (see, e.g., Agarwal and Prasad 1999; Amoako-Gyampah and Salam 2004; Venkatesh and Davis 1996) has focused only on the explanation of the logical causation and formation of belief, leaving the illogical factors unexplored. Moreover, belief from an individual perspective has been investigated whereas few studies have addressed IT adoption initiated at a group or committee level. Therefore, research is needed to explore belief formation from diverse perspectives, with evaluation of both logical and illogical forces in the same setting at the group or committee level.

The purpose of this study is to fill this research gap by examining how logical and illogical forces impact the beliefs of ERP steering committee members and studying the interaction of these two types of forces in an ERP adoption environment. We believe that the gap in the current literature lies in that which is outside the technical evaluation of ERP systems; hence, we focus on the intrinsic aspects of adoption behavior, which could eventually help in the better understanding of adoption decisions that cannot be explained by existing models. After all, non-technical forces such as isomorphic pressure (Hawley, 1986, DiMaggio and Powell, 1983) can lead to a change in belief, resulting in illogical mimetic behavior in ERP-adopting organizations. These illogical imitative forces are considered to interact with rational forces to influence, either directly or indirectly, the beliefs of steering committee members in the ERP evaluation process. In this study, DOI is chosen as a reference model for rational ERP adoption forces because of its maturity and theoretical completeness, along with its capacity to investigate organizational ERP systems. The imitation model (Haunschild and Miner 1997) is chosen as a reference model for illogical adoption forces because of its comprehensive classification of imitation modes.

Our research contributes to IT adoption research by providing a new perspective for the assessment of the psychological state of committee members in the ERP adoption process through evaluating the impact of both rational and imitative forces on belief at the organizational level. The findings of this research probably could explain why ERP was still prevalent despite its high failure rate; how isomorphic pressure entails ERP adoption; and how our research model shows this variance. This study also provides fresh theoretical and practical groundwork on these two forces and their interaction for future research. Existing theories are the foundation of our model, which we believe could further the cumulative tradition in IS research. Finally, our study makes not only academic but also practical contributions. Knowing what affects beliefs about IT will help prevent failure in IT adoption, which can affect an entire organization.

## **Theoretical Background**

### ***Imitation Theories***

Mansfield (1961) pointed out that an increase in the number of organizations that adopt an innovation influences the subsequent adoption decisions of other organizations. This is known as interorganizational imitation. A literature review reveals that theorists have proposed a number of potential imitation modes and theories to explain this unique organizational behavior, such as bandwagon theory (Abrahamson, 1993). The bandwagon effect occurs when people follow the crowd and “hop on the bandwagon” regardless of the underlying evidence, hoping to be associated with success. This effect is supported by institutional isomorphism theory, which holds that isomorphism is a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions (Hawley, 1986, DiMaggio and Powell, 1983).

Drawing on institutional and learning theories, Haunschild and Miner (1997) distinguish three distinct modes of interorganizational imitation – frequency based, trait based, and outcome based. In frequency-based imitation, if there are enough social actors carrying out a particular action, then this action will be taken for granted and other social actors will take similar action (March 1981). Trait-based imitation can be seen as a more selective form of imitation (Lu, 2002). Organizations often identify themselves with other organizations that they view as more legitimate or successful, because this is what they are all striving to achieve. Trait-based imitation is based mostly

on social, rather than technical, considerations, because it is often the trait that influences the decision-making process and not the potential outcome. Outcome-based imitation is based primarily on technical considerations, as this type of imitation proceeds from the perceived consequences of practices; therefore, outcome-based imitation is more likely to be a technical process than a social one. In outcome-based imitation, organizations will tend to adopt the practices of other organizations that yield positive or successful outcomes.

In the IS literature, empirical studies of imitation are few, but the imitation effect has been investigated using the aforementioned imitation theories (see, e.g., Teo et al. (2000); Hu and Huang (2006); Liang et al.(2007)). Some IS researchers have adapted herding theory, which was developed by information economists (such as Anderson and Holt [(1997)] and Hung and Plott (2001))), who suggest that herd behavior may arise because of information cascades. This behavior occurs when rational individuals ignore their private signals and instead mimic the actions of previous decision makers or follow established patterns (Anderson and Holt, 1997, Liang et al., 2004). Information cascades, however, are not the only cause of herding behavior in adoption. This problem can be exacerbated if there are strong network effects (Liang et al., 2004). Leading technologies can grow significantly more dominant with positive network feedback. Therefore, both information cascades and positive network feedback are mutually reinforcing in many IT markets, and have a profound effect on IT adoption as they change the dynamics of IT competition and diffusion.

In the context of ERP, imitative forces can be treated as new external information imposed upon committee members for assessment. Such assessment can change the beliefs of ERP steering committee members through discussion, which leads to a shared belief in the ERP system proposed for adoption. Fishbein and Ajzen (1975) argue that many of our beliefs are not logically formed from our experience or inference processes, but rather by external information or forces that establish a link between the object of the belief and some other object, value, concept, or attribute. Hence, we chose Haunschild and Miner's (1997) imitation model as a reference model for the illogical, external forces that influence the formation and change of beliefs of ERP steering committee members.

### ***Diffusion of Innovation Theory***

The success of innovation adoption and diffusion, to a great extent, is dependent upon the characteristics of the innovation as perceived by the organization (Premkumar et al., 1994, Chau, 1997, Teng et al., 2002). Consequently, many DOI studies in the past few decades have investigated the effect of innovation characteristics on its adoption and diffusion. This line of research indicates that a large number of innovation characteristics are critical to the adoption and diffusion of various types of innovation (Rogers, 2003). Tornatzky and Klein (1982) investigated the relationships among 25 innovation characteristics and adoption and diffusion through meta analysis of seventy-five research articles. They identified ten characteristics – compatibility, relative advantage, complexity, cost, communicability, divisibility, profitability, social approval, trialability, and observability – that were most frequently studied by researchers. Of these characteristics, compatibility, relative advantage, and complexity were consistently found to be significant. Since then, many DOI research studies of innovation adoption and diffusion (e.g., Brancheau and Wetherbe (1990); Grover and Goslar (1993 ); Lai and Guynes (1997)) in the IS field have employed these three variables.

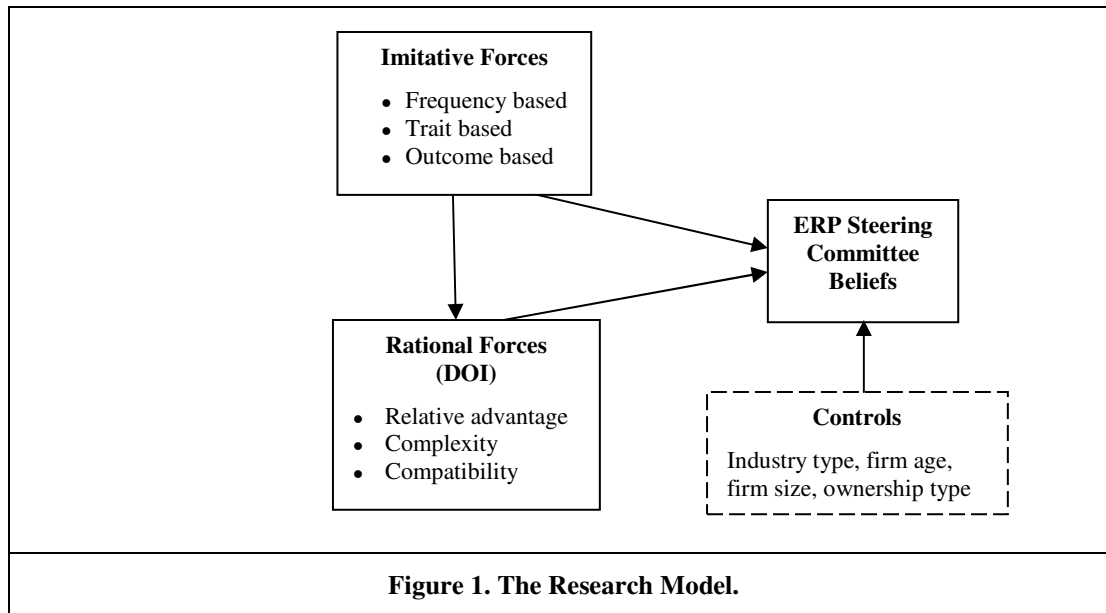
In this study, DOI represents the technical evaluation of an ERP system in a systematic and logical manner. Committee members go through the evaluation process together, analyzing the features, functions, capacities, costs, and benefits of the ERP system intended for adoption. Sometimes the evaluation process is assisted by ERP vendors, who may provide statistics and experience on ERP adoption, usage, and implementation. Such information affects the beliefs of ERP committee members resulting in a more informed scientific and logical evaluation process.

### **Research Model**

The purpose of this study is to examine how DOI and imitative forces impact the beliefs of ERP steering committee members and to study a revolutionized model that integrates the aforementioned forces. In this paper, we compare the three models side by side and discuss their relative strengths and weaknesses.

The three research models examined in this study are the imitation, DOI, and proposed integrated model (shown in Figure 1). In the imitation part of our model, we have included Haunschild and Miner's (1997) three forms of imitative behavior – frequency based, trait based, and outcome based – to attempt to evaluate their effects on the beliefs of ERP steering committee members. In the DOI section, only three variables – relative advantage,

complexity, and compatibility – were considered for testing because they were found to be the most significant factors in Tornatzky and Klein’s (1982) meta analysis and are widely accepted. In the integrated model, we believe that imitative adoption behavior will have a direct effect on rational DOI behavior in the ERP evaluation process because of bounded rationality. These two types of behavior will subsequently impact the beliefs of ERP steering committee members. To control for the effects of firm size, firm age, ownership type, and industry type, which might affect ERP steering committee beliefs, we used these four variables as control variables.



In this study, ERP has been chosen as the technology for investigation because it is an expensive technology that affects the entire organization (Shore, 2006, Zhang et al., 2005), which leads potential adopters to evaluate the technology thoroughly, including following industry leaders, to minimize adoption risks.

## Research Hypotheses

### *The Imitation Model*

With frequency-based imitation, organizations are more likely to imitate a certain action if that action has been taken by a large number of other organizations (Haunschild and Miner 1997). Organizations are compelled to adopt certain types of behavior because of their desire for legitimacy (Tolbert and Zucker, 1983, DiMaggio and Powell, 1983, Meyer and Rowan, 1977). Sometimes the imitative effect occurs as an unconscious form of influence, resulting in innovation adoption without thinking (March, 1981). Considerable empirical support exists for frequency-based imitation, including Haunschild and Miner’s (1997) study of the imitative use of a particular investment bank in acquisitions, Lu’s (2002) research into the imitation of the entry mode choice of firms in international expansion, and Haveman’s (1993) study of the imitation of a firm’s market entry decision.

The massive introduction of ERP systems into organizations is bound to have critical implications for those that are still considering or have not adopted one. The 67% adoption rate of such systems among mid- and large-sized organizations (Liang et al., 2007) enhances the legitimacy of the ERP practice and suggests the technical value of ERP, which leads to greater consideration of the adoption of these systems by others. The increase in the frequency of ERP system adoption directly creates positive externality and changes the competitive landscape. Consequently, many companies are “forced” to adopt an ERP system because their major clients have, whereas others adopt such a system because many of their rivals in the same industry have already done so. In many cases, companies are afraid that without the technology, they will lose their competitive advantage, or that they will be deemed old fashioned or

laid back if they do not follow the current trend and risk losing support from their stakeholders. Hence, the frequency of ERP system adoption may serve as a valid proxy/indicator of the technical value of ERP, which in turn could influence the beliefs of top management favorably, leading to the subsequent adoption of an ERP system. These phenomena have been described in the bandwagon theory (Abrahamson, 1993) and validated in studies such as those of Fligstein (1985) and Palmer et al. (1993). Therefore, we postulate the following.

*Hypothesis 1: The perceived number of organizations using a particular ERP system has a positive impact on the belief of the steering committee in the ERP adoption process.*

Companies including Wal-Mart and Dell see ERP as a good way to cut costs and increase profit margins (Shore, 2006), which is crucial for their success and makes them leaders in their respective industries. Unfortunately, many ERP initiatives fail because organizations do not understand the resources and commitment required for ERP system implementation and plunge in simply because other big players already have ERP systems (Silvestro and C., 2002, Zhang et al., 2005). Despite these failures, management still believes that imitating large and successful organizations will reduce the chance of ERP failure. Liang et al. (2007) argue that top management succumb to pressure, imitating their successful peers or competitors to maintain the legitimacy of their ERP adoption decisions and avoid any potential loss of face. Thus, ERP steering committee members mediate the impact of trait-based imitative forces on ERP adoption. In other words, they serve as gatekeepers, evaluating the ERP practices of leading organizations and their benefits, and form favorable or unfavorable beliefs that are translated into actions for adoption decision making and implementation. Hence, we posit the following.

*Hypothesis 2: The perceived success of organizations using a particular ERP system has a positive impact on the belief of the steering committee in the ERP adoption process.*

ERP systems have emerged as complete business software systems that, ideally, facilitate technical and business organizational integration without geographical restrictions (Ranganathan and Brown, 2006, Sheu et al., 2003). In practice, however, ERP system implementation is complex and ERP success is even harder to achieve (Zhang et al., 2005). Therefore, potential ERP adopters need to analyze the adoption outcomes of successful ERP adopters and evaluate these outcomes in their own context. ERP vendors often publicize the positive outcome of their customers as a marketing strategy to change perceived ERP values, especially given the low success rate of ERP. Copying organizations based on their successful ERP use generates a second-mover advantage of unexpected or unsought unique benefits, including the accrual of an external referent of prestige. These unanticipated benefits, along with the expected benefits of lower adoption risks and costs, could favorably shape the beliefs of members of management about an ERP system, leading to its eventual adoption. Therefore, we propose the following.

*Hypothesis 3: The perceived good performance of organizations using a particular ERP system has a positive impact on the belief of the steering committee in the ERP adoption process.*

### ***The DOI model***

DOI research findings show a strong correlation between an innovation's relative advantage and a user's attitude toward its use. Chau and Lai (2003) and Liao et al. (2002), for example, have empirically confirmed that relative advantage has a significant direct effect on attitude toward the use of Internet banking. Regarding intention to adopt and actual system use, Tan and Teo (2000) also provide evidence to support the criticality of relative advantage to intention to use and eventual use of an innovative IT. It is obvious that the benefits of an ERP system supersede most of its competing systems, which in turn could favorably influence the beliefs of steering committee members about possible ERP adoption. Hence:

*Hypothesis 4: The perceived relative advantage of an ERP system has a positive impact on the belief of the steering committee in the ERP adoption process.*

The incompatibility of an ERP system with existing values, past experience, and needs has a negative effect on its adoption and diffusion. An incompatible innovation inhibits further innovation use and implementation because of adoption resistance and implementation complexity. Prior DOI research (e.g., Moore and Benbasat (1991); Tornatzky and Klein (1982)) has shown that practical compatibility and value compatibility are both considered essential in adoption decision making, and that incompatibility of either can significantly negatively affect the innovation's use and adopters' attitude. Chau and Hu (2001) also find that when users are entrenched in a particular working habit, it is unlikely that they will accept a technology that is perceived to be incompatible with their

practices. Subsequently, it is likely that the incompatibility of an ERP system will negatively influence the beliefs of steering committee members, which will lead them to evaluate the system negatively.

*Hypothesis 5: The perceived compatibility of an ERP system has a positive impact on the belief of the steering committee in the ERP adoption process.*

ERP systems are difficult to understand, use, and implement (Gosain et al., 2005, He, 2004, Ko et al., 2005), although they exhibit higher performance across a wide variety of financial metrics (Newman and Westrup, 2005). In practice, ERP system implementation has a low success rate of 10% (Zhang et al., 2005), and the use of such complex information systems has continued to challenge their adopters (Ko et al., 2005). The association among learning, complexity, and IT adoption has also been validated in prior TAM and DOI investigations. These studies have identified the positive effects of perceived ease of use (Chau, 1996, Davis, 1989, Mathieson and Keil, 1998) and negative effects of perceived complexity (Brancheau, 1990, Grover and Goslar, 1993, Lai, 1997, Rogers, 2003, Tornatzky and Klein, 1982) on a user's attitude toward, intention to use, and eventual adoption of a technology. Hence, we postulate the following.

*Hypothesis 6: The perceived complexity of an ERP system has a negative impact on the belief of the steering committee in the ERP adoption process.*

### ***The Integrated Model***

Much research has been conducted into cognitive biases in managerial decision making and has consistently shown that managers are boundedly, or not perfectly, rational (e.g. Chaiken, 1980, Hammond et al., 1998, Simon, 1997). Therefore, based on the theory of bounded rationality, a manager (or a group of them) will be unlikely to be able to digest a large number of statistical reports, financial analyses, and case studies when trying to make an ERP adoption decision, or to relate every single piece of the available information (the manifestation of bounded rationality). Rather, he or she will likely be focused on only a few salient subsets of the entire available information, such as whether other companies have been using the system with very good results. Hence, we propose that imitative forces have an impact on the effort put into evaluating an ERP system because once managers regard that imitating bigger, more profitable competitors is satisficing (under the bounded rationality concept), this will be enough to end further investigation into the matter.

*Hypothesis 7: Frequency-, trait-, and outcome-based imitative forces have a direct impact on the evaluation of an ERP system's relative advantage, complexity, and compatibility.*

### ***Control Variables***

To account for differences among organizations, this study included four control variables that can potentially impact ERP adoption decision making, which are suggested by prior studies. These controls include firm size, firm age, ownership type, and industry type.

## **Methodology**

### ***Instrument Development and Pre-Test***

This study used a number of measures to ensure the validity and reliability of the instrument. First, whenever possible, previously validated questions were used. Second, the questionnaire was pre-tested by two business professors with expertise in survey research and eight IT professionals with significant ERP experience. Third, following Mullen's (1995) and House and Singh's (1987) two-step method, the questionnaire, which was originally in English, was translated into Chinese. The translated Chinese questionnaire was then translated back into English, which version was then compared with the original English version by two native Chinese IS professors from the School of Business to check the translation. The feedback from this phase of instrument development resulted in significant refinement of the survey, which improved its content validity.



Fourth, a field study of 52 graduate MIS students with work experience and ERP knowledge was conducted to assess the reliability and construct validity of the resulting scales. In most cases, we use more than one item to measure the same construct to reduce extraneous effects of individual items. Items measuring the same construct were not placed together; rather, they were placed at intervals to further enhance the reliability of the scale. Some of the questions were also reversed to ensure that the subjects read the questionnaire carefully. The feedback from the pilot test was used to improve the readability and quality of the questions in the instrument and the format of the questionnaire, resulting in the addition, removal, and rephrasing of several items.

### **Data Collection**

A standardized survey interview method was used for data collection. The goal of standardization is to ensure reliability and validity by interviewing every respondent with the same questions in the same manner and order. Although this interview method is time consuming and resource intensive, it ensures a higher response rate, more control of the actual respondent, and a higher quality of data collected (Fowler 1993). To reduce interviewer-related errors associated with the use of multiple interviewers, the guidelines suggested by Fowler and Mangione (1990) for standardized survey interviewing were followed.

A total of thirty graduate MIS students from a major university in Beijing participated in the first stage of this project, with the understanding that not all of them would be hired in the second stage as interviewers. These students were already familiar with ERP concepts and had experience in conducting an academic survey. Nevertheless, they were provided with one day of training in ERP and interview techniques, together with the background of our project. They were also provided with reviews of the questionnaire items, and participated in mock interviews with trainers. To maximize the consistency and standardization of interviewing, the students were given a standardized script with opening and closing remarks and asked to read the questions exactly as they were worded in the questionnaire. At the end of the training, sixteen students were short-listed, based on their performance in the training period, to participate in our project as interviewers.

An ERP list, which included 379 companies in Beijing, Shanghai, and Chengdu, was compiled from various sources. These companies were contacted by the graduate students to obtain information on members serving on ERP steering committees. Wherever possible, the highest ranking member of the committee was contacted for an on-site interview to answer the questionnaire. Because of time and resource constraints, only one committee member from each company was interviewed. This person's perspective was considered to be representative of the committee's belief about the ERP system as committee members had reached a collective decision on ERP adoption after a long decision process. A total of 154 interviews (one member from each company) were successfully conducted. Questionnaires were e-mailed to those who could not participate in on-site interviews, and a total of 56 e-mail responses were received. Follow-up phone calls were made to verify and validate the responses of the e-mail surveys. Two responses collected via e-mail were found to be substantially different from those collected during the follow-up phone call, so they were eliminated from the data set. Data collection took three months to complete, with a total of 208 usable responses.

We also adopted measures to minimize the impact of interviewer error on the data collected. First, the first completed survey instrument of each interviewer was carefully reviewed to assess the quality and reliability of data collection. Any issue identified in this review process was discussed, and the interviewer was also retrained prior to resuming his or her interview duties. Second, fifty-six surveys were randomly chosen from the completed surveys for validation. These respondents were contacted by the project supervisor, who randomly chose a few items from the questionnaire for the respondents to answer again. This validation process did not only ensure data reliability, but also ensured the interviewees specified in the responses had actually been interviewed. Although this measure was implemented on a small scale because it constituted a disturbance, we did not find much deviation between the first and second responses of these respondents. We also did not find any fault associated with the interviews.

### **Variable Operationalization**

All items of the research variables were rated on a 5-point Likert scale. The averaged aggregate scores of these surrogate factors provided the score for each research variable. Details of our measures are depicted in Table 2.

*Frequency-based imitation* was defined as the adopter's perception of the number of times that adoption of ERP occurs, and was measured using a four-item scale. *Trait-based imitation* was defined as the adopter's perception of

the positive distinguishing quality or characteristics of a company that had adopted an ERP system using the four-item scale developed by Haunschild and Miner (1997) and Liang et al. (2007). *Outcome-based imitation* was defined as the adopter's perception of the consequences of ERP adoption, and we developed a seven-item scale based on the most common advantages that would be expected to be gained by using an ERP system.

*Relative Advantage* was measured by asking the respondents to evaluate the extent to which the proposed ERP system could meet their business operation expectations compared to their current system. *Compatibility* was assessed using a three-item scale adapted from Karahanna et al. (1999), Lai (1997), and Liang et al. (2007). *Complexity* was assessed using a four-item reflective scale adapted from Lai (1997) and Liang et al. (2007), which measures the respondent's perception of his or her understanding and use of an ERP system.

*Steering committee beliefs* was adapted from the measure of top management belief in Liang et al. (2007). This three-item scale was modified for our context to measure the committee's beliefs about the value of ERP in business activities.

Four control variables were used: firm size, industry type, firm age, and ownership type. Firm size was measured by the affiliate's annual sales and number of employees; industry type was classified as finance, manufacturing, IT, insurance, health, and so forth; firm age was the number of years of business operation since its establishment; and ownership type was categorized as state owned, domestic private owned, joint venture, or solely foreign invested.

## Data Analysis and Results

### Profile of Respondents

Two hundred and eight subjects completed the questionnaire. Of these respondents, 52 (25%) were state-owned, 59 (28.4%) were domestic private-owned, 28 (13.5%) were joint venture, and 64 (30.8%) were foreign companies; 47.1% of these companies had less than 1000 employees, and 26% of them had more than 5000; and just slightly more than half had total fixed assets of less than RMB300 million. More than half (51.92%) had been operating in China for less than 10 years, and nearly 20% had been operating in China for more than 20 years.

The interviewees were mostly top management, including chief executive officers, chief information officers, chief financial officers, and chief operations officers. All these top executives accounted for 77.89% of our overall respondents. The remaining responses came from middle management, which include senior IT manager, senior sales managers, and senior finance managers. The seniority of our respondents suggested the reliability and quality of data collected.

Non-response bias was assessed using the procedure suggested by Armstrong and Overton (1977). First, the early quartile was compared with the late quartile of respondents regarding company characteristic variables and indicators of key constructs. Second, responses collected through on-site interviews were compared with those collected through the e-mail survey. The comparisons revealed no significant differences, suggesting that non-response bias was not likely to be present in our data.

### Measurement Model Analysis

Confirmatory factor analysis using AMOS 16.0 was conducted to test the measurement model. The overall model fit was assessed using five goodness-of-fit indices: the chi-square/degree of freedom ( $\chi^2/df$ ), normalized fit index (NFI), non-normalized fit index (NNFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The chi-square statistic was not used because of its sensitivity to sample size (Hartwick and Barki, 1994). The results of these indices, along with their recommended values for a common-value model, are depicted in Table 1. All indices exceeded the minimum recommended values, suggesting an adequate fit of the measurement model.

Table 1. Fit Indices for Measurement Model Analysis				
Fit Indices	Recommended Value	DOI Model	Imitation Model	Integrated Model

Chi square/Degree of freedom ( $\chi^2/df$ )	$\leq 3.00$	2.527	2.461	2.048
Normalized fit index (NFI)	$\geq 0.90$	0.971	0.971	0.956
Non-normalized fit index (NNFI)	$\geq 0.90$	0.977	0.972	0.973
Comparative fit index (CFI)	$\geq 0.90$	0.982	0.980	0.977
Root mean square error of approximation (RMSEA)	$\leq 0.08$	0.063	0.044	0.071

The measurement model was further assessed for its construct reliability and validity. Construct reliability was first evaluated using a composite reliability index. Table 2 shows that the composite reliability values of all variables ranged between 0.823 and 0.930, which is significantly above the 0.7 threshold level. The measurement model was also assessed with item reliability tests. The purpose of item reliability is to determine the amount of variance in an item due to the underlying construct rather than error. A coefficient of item reliability, which is the square of factor loading, of at least 0.5 is considered to be evidence of reliability. Table 2 shows that all items exceeded the minimum recommended value, thus confirming the reliability of our measurement model (Fornell and Larcker, 1981).

<b>Table 2. Summary of Measurement Scales</b>					
Construct	Mean	S.D.	Factor Loading	Comp. Rel.	AVE
<i>Relative advantage</i>					
Improving integration of internal business processes.	4.202	0.815	0.829	0.928	0.616
Improving production efficiency.	4.067	0.956	0.781		
Reducing operation costs.	3.928	0.884	0.809		
Standardizing business processes.	4.308	0.875	0.782		
Adapting business processes to international best practices.	3.986	0.945	0.757		
Improving the existing customer-facing services.	3.793	0.901	0.729		
Improving management control.	4.192	0.829	0.764		
Improving competitive competency.	4.014	0.843	0.825		
<i>Compatibility (Using ERP in our company will:)</i>					
cause disruption to the existing software environment.	2.572	1.118	0.832	0.823	0.609
cause disruption to the data processing environment.	2.635	1.117	0.814		
decrease productivity at first because of time to learn.	3.322	1.153	0.689		
<i>Complexity (It is difficult for my firm to:)</i>					
understand the use of ERP.	1.928	0.997	0.837	0.908	0.711
understand the business values of ERP.	1.938	1.022	0.869		
integrate ERP into the overall business process.	2.106	1.044	0.836		
make organizational changes to accommodate ERP.	2.236	1.020	0.830		
<i>Frequency-based imitation</i>					
Most of the companies in my industry have already adopted ERP.	3.495	1.188	0.876	0.906	0.709
Most of my customers have already adopted ERP.	3.135	1.216	0.703		
Most of my suppliers have already adopted ERP.	3.505	1.204	0.909		
Most of my competitors have already adopted ERP.	3.442	1.214	0.866		

<i>Trait-based imitation</i> (Companies that have adopted ERP in my industry are:)				0.930	0.768
very large.	3.659	1.169	0.871		
leading companies.	3.327	1.219	0.880		
very successful.	3.356	1.085	0.906		
favorably perceived by their suppliers and customers.	3.370	1.046	0.846		
<i>Outcome-based imitation</i> (Companies that have adopted ERP in my industry:)				0.914	0.604
are very effectiveness in their management.	3.447	0.946	0.748		
have very effective internal communication systems.	3.462	0.932	0.710		
are very profitable.	3.394	0.916	0.791		
have very good relationships with their customers.	3.442	0.888	0.819		
have very good relationships with their business partners.	3.447	0.866	0.816		
have a very high market share.	3.287	0.823	0.750		
have very high cost savings.	3.452	0.883	0.800		
<i>Steering committee beliefs</i> (The ERP steering committee believes that:)				0.827	0.617
ERP has the potential to provide significant business benefits to the firm.	4.043	0.929	0.8801		
ERP creates a significant competitive advantage for firms.	3.813	0.992	0.6893		
it is NOT necessary to use ERP to conduct business activities.	4.231	1.083	0.7754		

Regarding the instrument's construct validity, convergent validity was assessed by factor loadings and the average variance extracted. The rule of thumb for these assessments is that a factor with a minimum loading of 0.70 and a construct with a minimum of 0.5 average variance extracted are evidence of convergent validity. Our test results, which are depicted in Table 2, show that except for SCB2 (= 0.6893), all factor loadings and the average variances extracted were higher than the minimum recommended values. The tests for both factor loading and average variance extracted did not show any significant violations, thereby demonstrating adequate convergence validity of our model.

Following the suggestion of Fornell and Larcker (1981), discriminant validity was tested by examining the average variance extracted and the average variance shared between a construct and its measures. As shown in Table 3, the squared correlations of all seven entries, representing the shared variance among variables, were found to be consistently lower than the squared root of the diagonal average variance extracted. This suggests that our measures are distinct and unidimensional, thereby confirming discriminant validity at the construct level.

<b>Table 3. Correlations Among Constructs and Average Variance Extracted</b>							
	X1	X2	X3	X4	X5	X6	X7
Frequency-based imitation (X1)	<b>0.842</b>						
Trait-based imitation (X2)	0.220	<b>0.876</b>					
Outcome-based imitation (X3)	0.198	0.232	<b>0.777</b>				
Relative advantage (X4)	0.218	0.265	0.375	<b>0.785</b>			
Compatibility (X5)	0.248	0.192	0.395	0.136	<b>0.780</b>		
Complexity (X6)	-0.250	-0.264	-0.359	-0.119	-0.170	<b>0.843</b>	
Steering committee beliefs (X7)	0.334	0.352	0.496	0.435	0.358	-0.371	<b>0.785</b>

**Structural Model Results**

AMOS 16.0 was used to test the three structural models. Table 4 summarizes the degree to which each model fits the data. As indicated, the values of all five fit indices clearly exceeded the minimum recommended values suggested for a good model fit, suggesting the adequacy of our research models for further statistical analysis, including their causal link evaluation.

Fit Indices	Recommended Value	DOI Model	Imitation Model	Integrated Model
Chi square/Degree of freedom ( $\chi^2/df$ )	$\leq 3.00$	2.264	2.094	2.261
Normalized fit index (NFI)	$\geq 0.90$	0.970	0.961	0.951
Non-normalized fit index (NNFI)	$\geq 0.90$	0.975	0.960	0.967
Comparative fit index (CFI)	$\geq 0.90$	0.981	0.970	0.972
Root mean square error of approximation (RMSEA)	$\leq 0.08$	0.070	0.041	0.078

The overall explanatory power of the imitation, DOI, and integrated models was examined using the resulting  $R^2$ . The integrated model had an  $R^2$  of 43.1%, which was higher than that of the imitation (35.7%) and DOI (34.5%) models (Table 5), which indicates that the integrated, imitation, and DOI models explained 43.1%, 35.7%, and 34.5%, respectively, of the variance in steering committee beliefs.

Table 5 also shows the path coefficients of each model, along with their respective significance. All of the imitation and DOI paths were found to be significant. For the integrated model, only two out of the 15 paths were found to be insignificant. These included the paths from frequency-based imitation to relative advantage and from trait-based imitation to compatibility. Of the four control variables, only ownership type had a significant impact on ERP beliefs, suggesting that organizations with different ownership types have different beliefs about ERP systems.

	DOI Model	Imitation Model	Integrated Model
H1: Relative advantage → Belief	0.394**	--	0.269**
H2: Compatibility → Belief	0.236**	--	0.108*
H3: Complexity → Belief	-0.271**	--	-0.138**
H4: Frequency → Belief	--	0.230**	0.157*
H5: Trait → Belief	--	0.180**	0.126*
H6: Outcome → Belief	--	0.420**	0.255**
H7: Frequency → Relative advantage	--	--	0.120ns
Trait → Relative advantage	--	--	0.166*
Outcome → Relative advantage	--	--	0.313**
Frequency → Compatibility	--	--	0.163*
Trait → Compatibility	--	--	0.076ns
Outcome → Compatibility	--	--	0.345**
Frequency → Complexity	--	--	-0.157*

Trait → Complexity	--	--	-0.162*
Outcome → Complexity	--	--	-0.290*
Control variables			
Organization size	0.066ns	0.114ns	0.092ns
Organization age	0.100ns	0.062ns	0.090ns
Ownership type	0.150**	0.183**	0.183**
Industry type	0.031ns	0.017ns	0.005ns
R <sup>2</sup>	0.393	0.404	0.493
**p < 0.01; *p < 0.05; ns – not significant at the 0.05 level.			

## Discussion

### *Comparison of the DOI and Imitation Models*

As illustrated in Table 5, both the DOI and imitation model explained more than a third of the variance in steering committee beliefs. Although the imitation model had a slightly higher power in explaining the variance, the path coefficients of the two models suggest that they both have a significant and direct impact on beliefs. When the models are compared on the basis of valuable information provided, the imitation model could be seen to provide valuable intrinsic information on why people act in a particular way under a certain stimulus. In contrast, the strength of the DOI model is in the provision of specific information about innovation characteristics, and in the provision of a construct to measure the performance of these characteristics. These models attempt to describe human behavior in different ways. It is not surprising to observe that although each model contributes to a certain extent in explaining the variance in beliefs, neither of them outperforms the other because it is hard to find a situation in which a belief is formed purely on the basis of technical evaluation without being influenced by environmental factors, or vice versa.

In short, the above comparisons suggest that the imitation and DOI models have different focuses, strengths, and weaknesses, which prevents us from concluding that one model is better than the other.

### *Integration of the DOI and Imitation Models*

The integrated model explains almost 50% of the variance in steering committee beliefs, which is better than the 40% (39%) explained by the imitation (DOI) model alone. All of the imitation hypotheses were also supported. Although frequency-based imitation and trait-based imitation were significant only at the  $p < 0.05$  rather than the  $p < 0.01$  level, their direct effect is still indicative of a strong direct influence on beliefs. It is not difficult to imagine the amount of time and effort that a committee as a whole has to put into going through all sorts of documents and reports to evaluate an ERP system. One of the easiest and least expensive solutions is to “follow the crowd” to minimize the resources spent and gain legitimacy at the same time, which explains the strong direct effect.

Of the new integrated hypotheses postulated, only the relationships between frequency-based imitation and relative advantage, and trait-based imitation and compatibility were not supported; the others were supported by the empirical results. These findings suggest that when the imitation and DOI models are integrated, the former has an overall effect on the latter. The significant effect of all imitation variables on the DOI model also suggests the appropriateness of integrating the imitation and DOI models for technology research.

The insignificant correlation between frequency-based imitation and relative advantage suggests that an increase in the number of ERP users does not necessarily signify that the ERP system under evaluation is superior to the existing system it is going to supersede. An increase in the number of ERP users may only suggest that a company evaluating an ERP system could face increased pressure to adopt the system to gain legitimacy or recognition. Hence, the relationship between frequency-based imitation and relative advantage is not supported by our results. In addition, from a committee point of view, a big company using an ERP system is not proof that the system is more compatible, but could be a reflection of the vast amount of resources that a bigger and more successful company has

to make the system compatible with its daily routines and activities. This rationale is reflected in our empirical findings.

## **Conclusion and Implications**

Both the DOI and imitation model are found to affect the beliefs of ERP steering committees. As discussed, the selection of either model depends entirely on a researcher's objectives and preference. Our integrated model is also found to be useful in explaining the variance in the beliefs of these committees. Most of the independent and integrative paths proposed in the model were found to be significant in influencing, either directly or indirectly, the beliefs of steering committees in the ERP adoption decision process. Based on these findings, a number of implications for both researchers and practitioners can be drawn.

### ***Implications for Research***

The findings of this research suggest important avenues for future research. First, they show that imitative and DOI forces, both individually and taken together, play a significant role in affecting the beliefs of ERP steering committees. The consistency of the results indicates that more effort should be put into researching intrinsic motivation in human behavior in group decision making. Regarding the adoption of an expensive system such as an ERP system, decision makers would be advised to go through a set of evaluation procedures; unfortunately, as shown in our research, decisions are sometimes made that are not based entirely on technical evaluation. More research should therefore be conducted in this area.

In this study, only three DOI variables were selected as proxies for technology characteristics, which, in many aspects, may have restricted the explanatory power of our integrated model. Although our findings reveal that the three variables were relatively stable in both scenarios, other DOI variables need to be explored and/or investigated in the ERP context. For instance, technology costs, trust, risk, trialability, security, and convenience are some of features that might improve the appeal of the system in the eyes of committee members.

Our results also indicate that DOI and imitative forces and beliefs are closely related. Moreover, imitative forces have not only a direct effect on beliefs but also an indirect effect via DOI forces. Thus, imitative forces are one of the key motivations behind the eventual adoption decision. From a research point of view, it would be interesting to know how these forces interact to affect not only management but also lower level staff. Do they hinder or help ERP system implementation? Under what circumstances would these forces be weakened? Could they be strong enough to supersede the scientific evaluation of such a system? Another interesting intrinsic force that could be investigated in future research is fear. The fear of failure could moderate the relationship between imitative forces and beliefs, making organizations more susceptible to copying because of their desire for legitimacy. Researchers are thus encouraged to explore these relationships with a host of variables, mediators, and/or moderators.

Finally, our study was conducted in China, using Chinese subjects. China is different from Western countries as measured using Hofstede's cultural dimensions – power-distance, uncertainty avoidance, masculinity, and individualism. Therefore, for validation of the present study's findings, future studies must be conducted in other regions of the world to examine the integrated model's applicability across time, setting, and culture.

### ***Implications for Practitioners***

From a manager's or potential adopter's standpoint, the finding of the strong and consistent direct effect of imitative forces suggests that decision making is affected by imitation, with or without conscious knowledge of it. Imitating others is not necessarily a disadvantage; sometimes it can bring second-mover advantages and be beneficial to the company. However, managers and decision makers need to be aware of the presence of these forces and the consequences they can bring, so that a suitable judgment can be made that leads to the maximization of returns for the company.

However, imitative forces can help ERP vendors or consultants promote their products or services. In addition to promoting the system's benefits and compatibility, relating success stories to potential clients can be crucial in sealing the deal. Of all of the hypotheses we postulated, outcome-based imitation was consistently significant. This

is also supported by the notion of bounded rationality, which holds that a salient outcome can be treated as the cause of satisficing, leading to commitment to a technology innovation.

## **Limitations**

Our study has some limitations. First, our assessment of DOI-imitation integration is based on only one form of IT, that is, ERP systems. A more thorough evaluation of a wider range of IT would provide a better understanding of the effects of integrating these two models. Second, our study aimed to conduct interviews with top managers within ERP adoption committees. However, because of time and resource constraints, we were not able to solicit more than one respondent from each of the responding companies to confirm the findings. Although we believe that ERP adoption decisions are the result of the concensus of opinion of ERP steering committee members, and that the ERP beliefs of the members might be congruent, this supposition may be erroneous in a few of the cases. Hence, the multiple-response approach is more appropriate to explore organizational beliefs about ERP adoption. Another limitation is that of the timing of the interviews. Imitation assessment could have changed with time and experience of ERP-adopting companies. Early adopters, we believe, are more likely to follow a more rational path and exercise more caution; in contrast, followers are more prone to peer pressure and less caution. Early ERP adopters tend to invest more resources to investigate the suitability and effect of implementing an ERP system. Followers, however, may be pressured into implementing such a system because of the desire to integrate with others, or, after having heard or seen success stories, desire such success. Future research needs to delineate the impact of imitative and rational forces on ERP evaluation at different stages of adoption and implementation. A longitudinal investigation would be an appropriate approach to address this timing issue.

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