TAM-based external factors related to ERP solutions acceptance in organizations

Simona Sternad Zabukovsek
Faculty of Economics and Business, University of Maribor
Razlagova 14, Maribor 2000
Slovenia
www.shortbio.net/simona.sternad@uni-mb.si

Samo Bobek
Faculty of Economics and Business, University of Maribor
Razlagova 14, Maribor 2000
Slovenia
www.shortbio.net/samo.bobek@uni-mb.si

Abstract:
To improve the efficiency and effectiveness of ERP solutions use, understanding of critical success factors of ERP solutions assimilation in organizations is crucial. The technology acceptance model (TAM) proposed by Davis (1989) has been the most widely used model for researching user acceptance and usage of IT/IS. The purpose of this paper is to extend the original TAM with groups of external factors which impact actual ERP system use. First, we focus on ERP system use in companies' maturity phase. Second, we expose and examine three groups of external factors which influence ERP usage. The model was empirically tested using data collected from a survey of ERP users in 44 organizations. Survey data have been collected from ERP users who have been exposed to an ERP system which has operated for more than one year. The proposed research model was analyzed using the PLS approach.

1. Introduction

Enterprise resource planning (ERP) solutions can be viewed as: (1) a set of packaged application software modules, with an integrated architecture, that can be used by organizations as their primary engine for integrating data, processes, and IT in real time across internal and external value chains; (2) deep knowledge of business practices that vendors have accumulated and stored from implementations in a wide range of client organizations and that can exert considerable influence on the design of processes within new client organizations; and (3) a generic 'semi-finished' product with tables and parameters that client organizations and their implementation partners must configure, customize, and integrate with other computer-based IS to meet their business needs [1]. These solutions are "web enabled", meaning they work using web clients; this makes them accessible to all of the organization's employees, clients, partners, and vendors at any time and from anyplace, thereby promoting the business units' effectiveness [2]. The ERP solution's goal is to make information flow be both dynamic and immediate, thereby increasing the usefulness and value of the information. In addition, an ERP solution acts as central repository eliminating data redundancy and adding flexibility. In summary, ERP solutions are the mission-critical IS in today's business organizations and solve the critical problem of integrating information from various sources both inside and outside the organization's environment to make it available in real time to all employees and partners of the organization.

Ross, Vitale, and Willcocks [3] identified five stages ERP solutions lifecycle: (1) design; (2) implementation; (3) stabilization; (4) continuous improvement (maturity stage); and (5) transformation. In the ERP design stage, organizations make two important design decisions: one about process change and another about process standardization. In the implementation stage, organizations carefully plan implementation, deploying implementation teams to train users on the new solution and, to some extent, on new processes. Most found that "going live" tended to be highly disruptive as the new solution tended to be linked to new processes. However, it was not possible to implement the new solution and the new processes separately because they were highly interdependent. Consequently, "going live" introduced major organizational changes. In most cases, managers involved with implementations have found they had underestimated the extent to which individuals would be affected. A period of stabilization often immediately follows implementation, during which time the organization attempts to clean up its processes and data and adjust to the new environment. The typical stabilization period for an initial implementation is 4 to 12 months. For this stage, it is usual that an initial performance dip occurs, although the intensity and length of organizations' performance dips vary. Following stabilization, organizations enter a maturity stage in which they add functionality through new modules. During this stage, organizations are focused primarily on continuous improvement, but they are also starting to engage in process redesign to implement new structures and roles to leverage the solution. The transformation stage involves changing organizational boundaries, particularly with regard to solutions, which means the extension of the ERP into customer and supplier solutions.

ERP solutions have been implemented in most organizations recently, but it seems that majority of companies are unable to point out the most important contributions of their ERP systems. Supposedly, the use of ERP solutions significantly reduces the time to complete business processes and helps organizations share information [4]. Generally offer a better work environment for their users as they are given a more efficient system with which to work. However, instead, ERP systems have been plagued with high failure rates and an inability to realize the promised benefits [5]. Much of the success of ERP implementation lies in the operational phase of the ERP solution lifecycle. After the stabilization stage, companies enter a maturity stage during which time they should put more effort into people and process improvements [6]. In this stage, users accept the system, and the usage becomes a regular day-to-day activity. It often takes many months or even years for experienced users to become comfortable with the ERP system. However, at some point in the ERP system's life, users begin to see its advantages and they then begin to explore its functions, gradually reaching success. This process demonstrates that ERP users have accepted the ERP system and are putting it to extended use. The impact of ERP systems on users and their acceptance have been recognized as key factors of ERP implementation success.

To improve the efficiency and effectiveness of ERP system use, organizations need to research the factors that impact user satisfaction. In this area, the technology acceptance model (TAM) 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 could help increase efficiency and effectiveness of ERP system use [7]. A review of the literature indicates that, in recent years, only a few studies examining users' adoption of ERP systems through TAM have been published (for the latest research, see [4],[7]-[10]. However, all of them examine a few contextual factors that influence the intention to use an ERP system or ERP use in the stabilization stage. In addition, very few studies have been conducted regarding technology acceptance of ERP systems, especially those dealing with autonomous ERP users (i.e., [9]). Through their scientific work, researchers have recognized that the generality of TAM and their research of small numbers of additional factors that impact TAM fail to supply more meaningful information on users' opinions about a specific system - especially an ERP system, which is considered a strategic IS in organizations. Therefore, the need exists to incorporate additional factors or integrate it with other IT acceptance models for improvement of its specificity and explanatory utility (i.e., [11],[12]).

The purpose of this paper is to extend the original TAM with groups of external factors which impact actual ERP system use. Survey data have been collected from ERP users who have been exposed to an ERP system which has operated for more than one year. The proposed research model is analyzed using the PLS approach. The rest of this paper is organized as follows: a literature review; an enterprise resource acceptance model; methodology; results and analysis; discussion; and then the conclusion.

2. Literature Review

2.1 Technology Acceptance Model (TAM)

Several theoretical models have been used to investigate the determinants of acceptance and use of new information technology (IT), such as the theory of reasoned action (TRA; [13]), the theory of planned behavior (TPB; [14]), and the theory of the technology acceptance model (TAM; [15]). Compared to competing models, TAM is believed to be more parsimonious, predicative, and robust ([12],[16],[17]); consequently, among the theoretical models, it is the most widely used by IS/IT researchers ([4],[15],[18],[19]). The key purpose of TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions [15].

TAM posits that two beliefs - perceived usefulness (PU) and perceived ease of use (PEOU) - are of primary relevance for computer acceptance behavior [15]. PU is defined as 'the degree to which a person believes that using a particular system would enhance his or her job performance' ([19], p. 320). In contrast, PEOU refers to 'the degree to which a person believes that using a particular system would be free of effort' ([19], p. 320). The two central hypotheses in TAM state that PU and PEOU positively influence an individual's attitude towards using a new technology (AT), which in turn influences his or her behavioral intention (BI) to use it. Finally, intention is positively related to actual use (AU). TAM also predicts that PEOU influences PU; as Davis et al. ([15], p. 987) explained, 'effort saved due to improved perceived ease of use may be redeployed, enabling a person to accomplish more work for the same effort'.

2.2 TAM and ERP systems

A review of past ERP studies regarding TAM indicates that few studies have investigated ERP user acceptance and usage, and only a small number of articles have been published. Furthermore, all of them expose small numbers of external factors which could influence ERP acceptance and usage in different phases of an ERP system lifecycle (see Table 1). As several studies (i.e., [20],[21]) have revealed, a common reason for ERP failures can be attributed to users' reluctance and unwillingness to adopt and use the implemented ERP system. A better understanding of the factors leading ERP users' acceptance of ERP systems is necessary to facilitate successful ERP usage [20]. In the current study, we aim to identify factors leading users to better use of their ERP system. Thus, the goal of our research is to expand the basic TAM with more generic contextual factors and examine their influence on perceived ERP usefulness and

perceived ERP ease of use. Studying the influence of external factors on constructs not only contributes to the theory development, but also helps in designing interventional programs for organizations.

Table 1. ERP Literature on TAM

Focus	Phase–ERP system lifecycle
They examined factor organizational support (formal and informal) on original TAM factors [4].	Post-implementation
They examined the formation of readiness for change (enhanced by two factors: organizational commitment and perceived personal competence) and its effect on the perceived technological value of an ERP system leading to its use [5].	Post-implementation (stabilization stage)
Their study attempted to explain behavioral intention and actual use through incorporated additional behavioral constructs: top management support, computer self-efficacy, and computer anxiety [7].	Post-implementation (maturity stage)
They examined factors (subjective norms, compatibility, gender, experience, and education level) that affect users' behavioral intention to use an ERP system based on potential ERP users at one manufacturing organization [8].	Implementation
They extended IT usage models to include the role of ERP's perceived work compatibility in users' ERP usage intention, usage, and performance in work settings [9].	Post-implementation (maturity stage)
They researched impact of PEOU, result demonstrability, and subjective norm on PU and impact of it on usage behavior [10].	Post-implementation (stabilization stage)
They tested the impact of four cognitive constructors (PU, PEOU, perceived compatibility, and perceived fit) on attitude toward using ERP system and symbolic adoption [17].	Post-implementation (stabilization phase)
Their study evaluated the impact of one belief construct (shared beliefs in the benefits of a technology) and two technology success factors (training and communications) on PU and PEOU in one global organization [18].	Implementation
They researched student readiness for change (through gender, computer self-efficacy, and perceived benefits of ERP) on behavioral intention regarding ERP implementation [22].	Implementation
They investigated via case studies the relationship between training satisfaction and the PEOU, the PU, effectiveness, and efficiency in implementing an ERP system at a mid-sized university [23].	Implementation
They researched the impact of PU and PEOU on extended use [24].	Post-implementation (maturity stage)
They developed a research model based on TAM for testing the influence of the critical success factors (top management support, communication, cooperation, training, and technological complexity) on ERP implementation [25].	Implementation
They extended TAM to research the selection of ERP by organizations using factors: impact of system quality, information quality, service quality, and support quality as key determinants of cognitive response as well as which ERP system to purchase/use [26].	Selection
He investigated the influence of personal innovativeness on general computer self-efficiency and PEOU, cultural orientation (power distance and collectivism) on PU, and impact of PEOU and PU on ERP personal innovativeness on intention to use) [27].	Implementation
They research the impact of change management on perceived benefits for user, user training and education's influence on benefits for organization, benefits of organization and benefits of user on financial performance, financial performance on ERP adoption [28].	Implementation

2.3 External factors

Research efforts have been devoted to extend the theory by examining the antecedents of PU and PEOU. As noted by Venkatesh and Davis [17], a better understanding of these factors would enable us to design effective organizational interventions that might lead to increased user acceptance and use of new IT systems.

Over the last two decades, substantial empirical support has emerged in favor of TAM (see [29]). Although TAM is a model applicable to a variety of technologies, the constructs of TAM need to be extended by incorporating additional factors [8]. Schwarz [30] reviewed identified antecedents to cognitive factors (PEOU and PU) and categorized the factors into three groups: individual variable (such as computer experience, self-efficacy, and prior experiences), organizational influences (such as management and external support and perceived resources), and technology characteristics (such as accessibility of the medium and interface type).

Meanwhile, Venkatesh and Bala [29] exposed four different types of determinants of PU and PEOU: individual differences, system characteristics, social influence, and facilitating conditions. In the context of ERP systems, in prior research we exposed that external factors include three groups of factors: personal characteristics and information literacy (PCIL), system and technological characteristics (STC), and organizational-process characteristics (OPC).

Personal characteristics and information literacy (PCIL) includes personality characteristics that can influence individuals' perceptions of ERP system acceptance and usage. PCIL factors include:

- Experience with computer is a determinant factor of behavior and has been found to be important factor for the acceptance of a technology [8];
- Computer self-efficiency is defined as the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer ([7],[29]);
- Personal innovativeness toward IT. According to the innovation diffusion theory [31], people react differently to a new idea, practice, or object due to their differences in individual innovativeness, a predisposed tendency toward adopting an innovation. Personal innovativeness toward IT represents the degree to which an individual is willing to try out a new IT [11]);
- Computer anxiety represents degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers" ([17], p. 349). Individuals with lower anxiety are much more likely to interact with computers than people with higher anxiety [7].

In contrast to most IT implementation research, the fact that ERP implementation research is focused on one technology has enabled the effect of specific technological characteristics to be examined. A lack of attention to system and technological characteristics is a serious deficiency in most IT implementation research. We have not found any research that has examined system and technology characteristics (SCT) upon the ERP system user acceptance. Surveying different studies of external factors has exposed:

- Data quality. ERP provides easy access to corporate data, but if the data are inaccurate or irrelevant to the business processes in the subunit, there will be few benefits. Thus, without accurate and relevant data, an organization is severely constrained in the coordination and task efficiency benefits it can achieve from its ERP system [32];
- ERP system functionality. System functions are used to measure the rapid response, stability, easy usage, and flexibility of the ERP system [33];
- ERP system performance refers to the degree to which a person believes that a system is reliable and responsive during a normal course of operations [18];
- User manuals (help) refer to the degree to which an ERP users views inadequate users manuals and help as the reason for one's unsuccessful ERP performance [34].

Organizational-process characteristics (OPCs) capture various social processes and mechanisms and support organizations that guide individuals to facilitate the use of an ERP system. OPCs include:

- Social influence which joins two factors: subjective norm and social factors. Subjective norm is defined 'as a person's perception that most people who are important to him/her think that he/she should or should not perform the behavior in question' [35]. Social factors are 'individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others in specific social situations' [36];
- Fit with business processes. ERP packages are built around best practices in specific industries [37]. But the software may not necessarily fit the operating practices of an adopting organization. Nah et al. defined perceived fit from an end-user's perspective as the degree to which the ERP system is perceived by a user to meet his/her organization's needs [20];
- Training and education on ERP system is an important component in ERP implementation projects and is recommended before, during, and after implementation [25]. Training and education on an ERP system are defined as the degree to which the user thinks that he/she has had enough formal and informal training after ERP implementation;
- ERP support. In an ERP system environment, if the organization provides sufficient support to ERP users for their tasks, they are more likely to enjoy their work and improve their performance through usage of the ERP system [4]. ERP support is defined as the degree to which an individual views adequate ERP support as the reason for his or her successful ERP usage;
- ERP communication problems refer to the lack of communication regarding the ERP applications and their modifications [34]. As a result, ERP communications has been defined as the degree to which an individual views sufficient communication regarding the ERP system as the reason for his or her successful ERP usage.

In summary, because of the high rate of ERP implementation failure, more research in the area of technology acceptance is needed [10]. The original TAM is well established and tested; furthermore, a variety of extensions have been developed in different IT environments. Regardless of ERP complexity and ERP implementation failure, very few studies have been conducted regarding technology acceptance, especially with regard to more external factors of ERP usefulness and ERP ease of use. Our study will contribute to the body of knowledge in this specific area.

2.4 Work Compatibility

In case of ERP implementations, other cognitive considerations beside perceived usefulness (PU) and perceived ease of use (PEOU) may become relevant [20]. In the ERP context, organizations have to adopt business processes of an implemented ERP system. Although one of the major benefits of ERP systems is that they offer to organizations solution with best business practices it is not necessary that this is the best options for ERP users. Inherent business rules behind the processes gives them little choice but to follow strict business processes of ERP system, unlike the old system, which allowed them many different processes variations [38]. So organizations deploy ERP systems to facilitate organizational work rather than to match users' personal preferences or habits. At this presume we view work compatibility (WC) strictly as the fit of ERP to organizational work, and not to personal preferences or work habits. Work compatibility, like perceived ERP usefulness (PU) and perceived ERP ease of use (PEOU), is very much a perceptual construct as it is the perception of fit between IT and work that motivates employees to use the system, irrespective of the actual extent of fit [39]. ERP work compatibility (WC) refers to "degree" to which can ERP user do most of their tasks in ERP system. Work compatibility (WC) influences perceived ERP usefulness (PU) and so it demonstrates the importance of incorporating work compatibility in models of IT usage as exposed i.e. Sun et al. (2009) and [40].

3. Enterprise Resource Acceptance Model

To examine ERP users' use of ERP systems, we need to extend the TAM model. Synthesizing prior research on TAM and research on ERP systems, a conceptual model that represents the cumulative body of knowledge from TAM and ERP research over the years has been developed (see Fig. 1). The grey area within the dotted line denotes the original TAM. Because our research is focused on a group of external factors which influence the current usage of ERP system in the routine stage, there is no need to examine the behavioral intention on use and actual use; thus, behavioral intention and actual use were dropped from purposed research model.

According to Davis perceived ease of use influences perceived usefulness while both perceived usefulness and perceived ease of use influence attitude toward using the system [19]. Therefore, the following hypotheses were proposed:

H1: Perceived ERP ease of use (PEOU) has positive and direct effect on perceived ERP usefulness (PU).

H2: Perceived ERP ease of use (PEOU) has positive and direct effect on attitude toward ERP system (AT).

H3: Perceived ERP usefulness (PU) has positive and direct effect on attitude toward ERP system (AT).
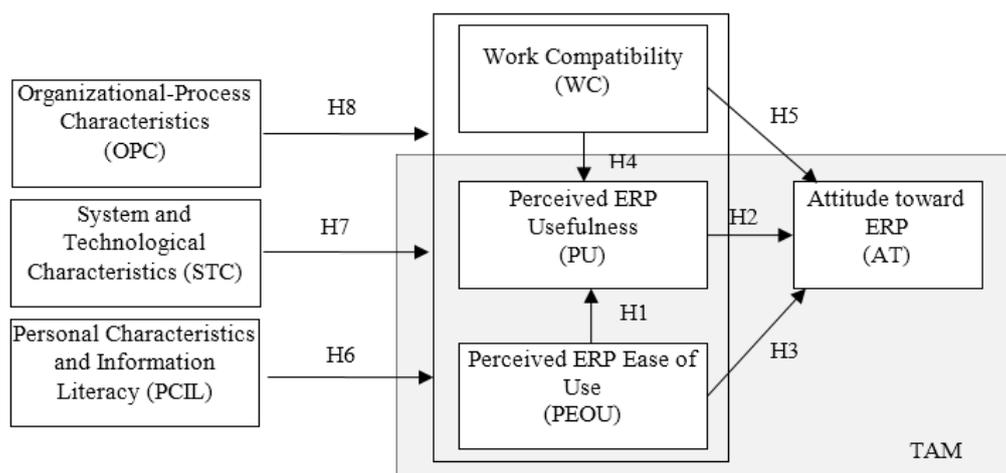

Fig. 1. Conceptual Model

In a context of ERP usage it is expected that relationship between work compatibility (WC) and perceived ERP usefulness (PU) as the more work compatible ERP system is, the more useful it is for ERP users. It can be argued that:

H4: Work compatibility (WC) between their organizational tasks and an ERP system is positively related to their usefulness (PU) of ERP usage.

We also presume that work compatibility (WC) has strong direct effect on Attitude toward using ERP system (AT), not just indirect effect through ERP usefulness as if ERP users believe that ERP system is more work compatible with their daily tasks, they will have more positive attitude toward using that system. Research with these relationships could not be found therefore these two hypotheses have been proposed:

H5: Work compatibility (WC) has direct positive effect on Attitude toward using ERP system (AT).

The problem of TAM research is that most researchers investigate small numbers of external factors that influence user acceptance and usage. In the context of ERP systems, more external factors exist that can influence users' acceptance. Thus, the conceptualization of higher-order factors (in our case second-order factors), in which more external factors jointly have to be included, have to be investigated if we want to extend our understanding of user behavior in ERP settings. On that presumption we hypothesize:

H4: A group of external factors influence use of the ERP system through the conceptual factor personal characteristics and information literacy (PCIL).

H5: A group of external factors influence use of the ERP system through the conceptual factor system and technological characteristics (STC).

H6: A group of external factors influence use of the ERP system through the conceptual factor organizational-process characteristics (OPC).

4. Research Methodology and Results

4.1 Research methodology

We tested our hypotheses empirically using a field survey of users of ERP systems in the maturity stage. Organizations were selected using two criteria: (1) the organizations must have implemented one of the two most popular global ERP solutions in Slovenia: SAP or Microsoft Dynamics; and (2) the organizations must have used the ERP system for more than one year at the time of the study. The initial e-mail explaining the purpose of the study was sent to a total of 122 companies. Each organization was required to verify that it matched our selection criteria; 44 organizations agreed to participate in the survey and were asked to distribute the survey questionnaire to their ERP users. All respondents were required to have used an ERP system in their daily work. Ultimately, 293 questionnaires were properly filled out by respondents and used for the purpose of analysis.

The constructs of the purposed model - perceived ERP usefulness, perceived ERP ease of use, work compatibility and attitude toward ERP use for basic TAM of ERP systems - are influenced by constructs of external variables. The constructs of external variables are distributed among three second-level constructs: personal characteristics and information literacy (PCIL); system and technological characteristics (STC); and organizational-process characteristics (OPC). PCIL includes experience with computer, computer self-efficiency, personal innovativeness toward IT, and computer anxiety. STC includes ERP data quality, ERP system functionality, ERP system performance, and user manuals (help). OPC includes social influence, fit with business processes, ERP training and education, ERP support, and ERP communication. Thus, our model includes 17 first-order factors and three second-order factors.

All the items of factors were measured on a 7-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'; the scale was adopted from relevant prior research and adapted to relate to the context of ERP usage. In addition, demographic information was collected. The instrument was pilot tested with a group of 30 ERP users in one organization. Based on the results of the pilot testing, revisions and additions were made to the instrument. Pilot participants were included in the main data gathering effort since they were part of the population of interest.

Models, which include second-order factors, consist of higher-order factors that are modeled as causally impacting a number of first-order factors (i.e., standard factors with measured indicators; [41]). Therefore, these second-order factors are not directly connected to any measurement items. The partial least squares (PLS) approach allows the conceptualization of higher-order factors by repeated use of manifest variables [42]. The empirical data were analyzed in two stages involving a PLS technique, using Smart PLS 2.0 M3 [43]. In the first stage, all measurement scales were examined for their psychometric properties; the second stage focused on hypothesis testing and analysis. Path significance was estimated using bootstrapping resampling techniques with 500 sub-samples. Detailed results and analyses can be obtained from the authors.

4.2 Results

As previously indicated, 293 questionnaires were properly filled out by respondents from 44 organizations and used for the analysis. Survey respondents represented different groups of industries, including IT and telecommunications (44.0%), manufacturing (35.2%), professional, scientific and technical activities (10.2%), wholesale and retail trade (4.1%), and others (6.5%). Respondents were 51.5% male and 48.5% female. Most (67.2%) had a high school education or more. More than half (53.6%; 157 respondents) indicated that they were workers (experts and other employees); others indicated low management (e.g. manager of group or organization unit), middle management (e.g., CIO) or corporate government and/or top management. The average total working years was 15.4 years, and average working years at their current workplace was 7.6 years. The ERP system had been used for 4.73 years, on average. The final version of model is presented in Fig. 2. Because all of the external factors did not meet assessment requirements of the measurement model, we excluded them from further analysis. These external factors included computer self-efficacy and experience with computer from PCIL group, ERP functionality from STC group and ERP support, ERP communications and ERP training, and education from OPC group (dotted shapes in Fig. 2).
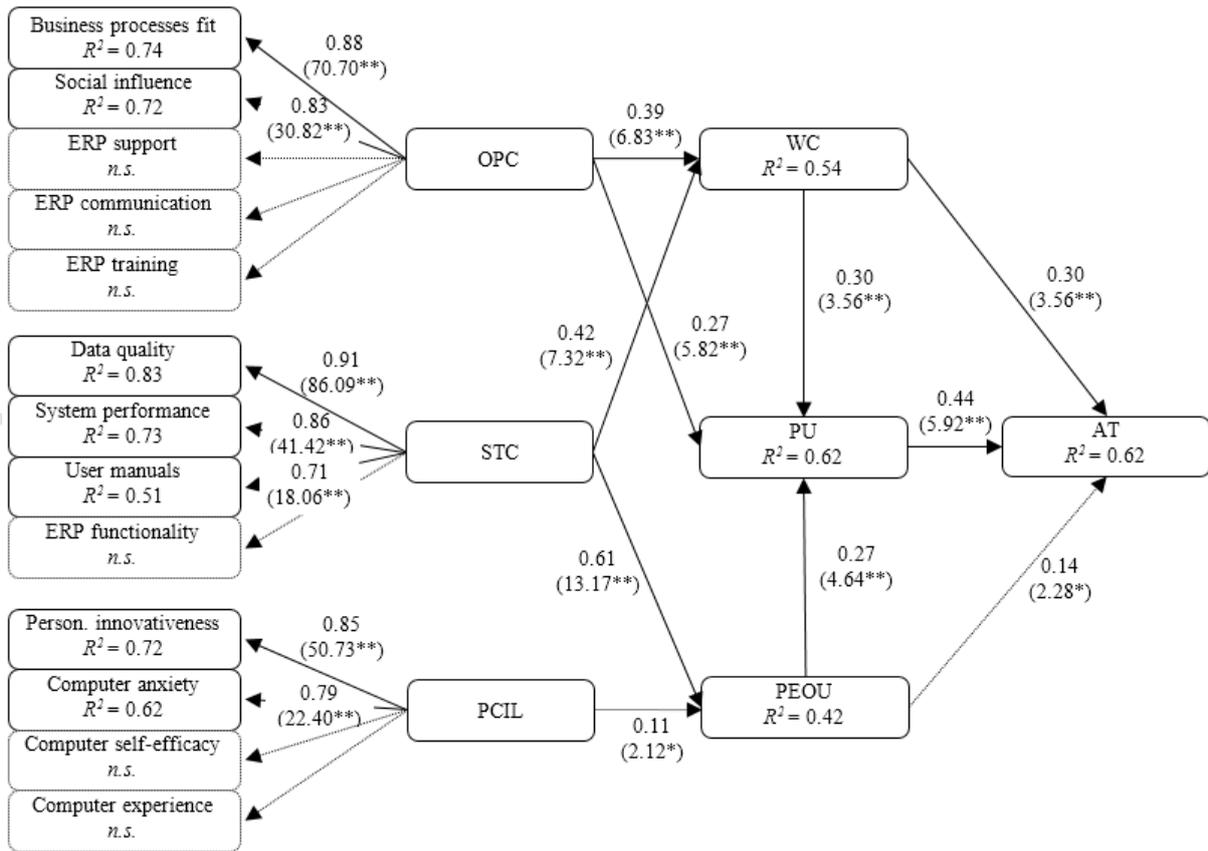

Fig. 2. Results of structural model analysis[a]

[a] Path significance: ** p < 0.01, * p < 0.05, n.s. = not significant (shapes are marked dotted).

Empirical research has shown support for original relationships of TAM in ERP settings in the maturity stage (for example, see [1],[4],[6],[21]). As shown in Fig. 2, our research confirms their results of the influence of perceived ERP ease of use (PEOU) and perceived ERP usefulness (PU) on attitude toward using ERP system (hypotheses H2 and H3) as well as influence of perceived ERP ease of use (PEOU) on perceived ERP usefulness (PU) (hypotheses H1).

Our research also confirms that work compatibility (WC) has a strong and significant positive effect on PU (hypothesis H4). Work compatibility (WC) also has a relatively weaker but significant positive effect on attitude towards ERP (hypothesis H5).

Fig. 2 also indicates that the loadings of the first-order factors on the second-order factors exceed 0.7, and second-order factors have significant positive effect on ERP usefulness and on ERP ease of use. PCIL has a weak but significant positive effect on ERP ease of use (b = 0.11, p<0.05); STC has a strong positive effect on perceived ERP ease of use (b = 0.61, p<0.01) and a strong positive effect on work compatibility (b = 0.42, p<0.01), and OPC has a strong positive effect on perceived ERP usefulness (b = 0.45, p<0.01) and on work compatibility (b = 0.39, p<0.01). These findings provide empirical support for hypotheses H6, H7, and H8.

5. Discussion

Perceptual construct work compatibility (WC) was presented as the degree to which an ERP user can do most of his or her tasks in an ERP solution. In our research, WC influences PU, which supports prior findings [39],[40]. Moreover, WC directly and indirectly (through PU) influences attitude toward ERP (AT); if ERP users can do most of their tasks in ERP solutions, they have a better attitude toward using ERP solutions.

Based on the analytical results, this study found that it is possible to observe more external factors through second-order factors. In the maturity stage, external factors' personal innovativeness and computer anxiety, through second-order factor personal characteristics and information literacy (PCIL), influence perceived ERP ease of use. Meanwhile, the external factors self-efficacy and computer experience were not significant.

In contrast to most IT implementation research, the fact that ERP implementation research is focused on one technology has enabled the effect of specific technological characteristics to be examined. We have not found any research which has examined the effects of system and technology characteristics (SCT) upon the ERP system's user acceptance. System and technological characteristics data quality, system performance, and user manuals have a strong impact on perceived ERP ease of use whereas ERP functionality was not statistical significant.

Furthermore, business process fit and organizational culture from organization-process characteristics (OPC) have a strong impact on perceived ERP usefulness. It is important for organizations to adopt the business processes of ERP solutions. Business process reengineering plays a particular crucial role in the early stages of implementation; it is moderately important in the acceptance stage but tends to be less important once the technology reaches the maturity stage [44]. However, our research shows that the business process fit is also important in the maturity stage. We cannot confirm Lee et al.'s conclusion [4] that, if an organization provides sufficient ERP support to organizational workers for their tasks, they are more likely to enjoy their work and improve their performance through the usage of the ERP system. Amoako-Gyampah and Salam discovered in their research that ERP user training and education had a significant impact not only during the implementation phases, but also in operation phases (and especially in the maturity phase), when training on a continuous basis is required to meet the changing needs of the business and enhance employee skills [18]. Our research shows that ERP users do not think that they need formal or informal training. ERP communication promotes users' trust of ERP systems, thereby leading to user acceptance and actual usage. ERP communication is viewed as having a high impact from initiation to system acceptance, as it helps minimize possible user resistance [44]; however, it was not found to be significant at the routine stage.

6. Conclusion

Although ERP solutions significantly reduce the time to complete business processes, help organizations share information [4], and lead organizations to offer a better work environment for their employees as by providing them a more efficient system with which to work, ERP solutions have been faced with high failure rates and an inability to realize promised benefits [5] in the maturity stage of the operational phase. Among the most important reasons mentioned problems seems to be that ERP users do not use these solutions properly. In our research we have analyzed influence of 13 external factors on increase of the degree of attitude of ERP users toward the ERP system. We extended already published research studies with different groups of external factors. Personal innovativeness, computer anxiety, self-efficacy, and computer experience are included in the conceptual factor personal characteristics and information literacy (PCIL). Data quality, system performance, user manuals, and ERP functionality are included in the conceptual factor system-technological characteristics (STC). Business processes fit, organizational culture, ERP support, ERP communication, and ERP training are included in the conceptual factor organizational-process characteristics (OPC). These three conceptual factors influence perceived ERP ease of use (PEOU), perceived ERP usefulness (PU) and work compatibility (WC), which further influence attitude towards using the ERP system (AT). Structural equation modeling (PLS approach) was employed to assess overall model fit to verify the causal relationships between factors. The aim of each organization that has implemented ERP solution should be that ERP users really use their ERP solution extensively. Through the researched model, we propose that organizations focused themselves more into the identified external factors that impact the second-order factors on ERP acceptance and usage. For more detail understanding of situation in each distinct organization, further research (including interviews with ERP users) should be conducted.

The research was based on an extended version of TAM through second-order factors to improve the explanation of ERP usage. The PLS approach for analysis of the model was used. Such research has the potential for explanation of the degree of ERP system usage. By confirming external factors, organizations should work on their organizational culture and business process fit, and conversely on their ERP system, to ensure better data quality, system performance, and user manuals for their users, thereby improving the degree of attitude towards an ERP system.

This study has certain limitations which may present the opportunity for further research. Since the respondents to the survey were limited to enterprises in one country, this study should be extended to other countries. Further research is needed to explore the importance of presented external factors in different phases of the ERP lifecycle as well as include additional external factors (e.g., top management support). Because ERP solutions are implemented by different methodologies and approaches, the importance of external factors by ERP solutions could also be explored. The impact of external factors on work compatibility as well as the impact of work compatibility on TAM should be researched.

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Biographical notes

Simona Sternad Zabukovsek

Simona Sternad is an assistant professor of Information Systems at the Faculty of Economics and Business at the University of Maribor. She has a Ph.D. in the field of management information science. Her research areas including business process reengineering, ERP and e-business solutions, and the implementation and maintenance of ERP solutions. Her bibliography includes more than 70 articles, conference papers, and research reports. She has collaborated in several courses at the undergraduate (E-business, Introduction to Information Systems, E-Finance and E-Banking, Enterprise Resource Planning Solutions, E-Business Information Systems) and graduate levels (Business Information Solutions, Strategic Management Issues in E-business). She also serves as a consultant for several companies in Slovenia.

www.shortbio.net/simona.sternad@uni-mb.si

Samo Bobek

Samo Bobek is a full professor of Information Systems at the Faculty of Economics and Business at the University of Maribor. He teaches undergraduate courses (Introduction to Information Systems, Information Systems in Finance and Banking) as well as courses in the masters of science (Information Systems Management, Management Information Systems, Information Systems in Service Organizations) and MBA programs (Information Management). His research areas include strategic information systems planning, information management, and banking technology. He has published several books in the Slovene language, and his bibliography includes more than 200 articles, conference papers, and research reports. He is the head of the Information and Organization Systems Department and serves as a consultant to several corporations, banks, and insurance firms in Slovenia.

www.shortbio.net/samo.bobek@uni-mb.si