DOI: https://doi.org/10.31341/jios.43.1.4
Open Access
UDC 004.4:001.891
Original Scientific Paper

Technology Acceptance Model Based Study of Students' Attitudes Toward Use of Enterprise Resource Planning Solutions

Simona Sternad Zabukovšek *simona.sternad@um.si*
Faculty of Economics and Business
University of Maribor, Maribor, Slovenia

Ruben Picek *ruben.picek@foi.hr*
Faculty of Organization and Informatics
University of Zagreb, Varaždin, Croatia

Samo Bobek *samo.bobek@um.si*
Faculty of Economics and Business
University of Maribor, Maribor, Slovenia

Irena Šišovska Klančnik *irena.sisovska@um.si*
Faculty of Economics and Business
University of Maribor, Maribor, Slovenia

Polona Tominc *polona.tominc@um.si*
Faculty of Economics and Business
University of Maribor, Maribor, Slovenia

Abstract

Enterprise Resource Planning (ERP) solutions are the most frequently used software tool in companies in all industries. Therefore, the labour market requires the knowledge and skills for usage of ERP solutions from graduates – future employees. The main objective of our paper is therefore the identification of important factors that contribute to the acceptance of ERP solutions by students in economics and business and that shape their intentions to use this knowledge in the future. The model of our research is based on the Technology Acceptance Model (TAM), extended by identified important multidimensional external factors that refer to (1) students' personal characteristics and information literacy, (2) perceived system and technological characteristics of ERP solutions and (3) perceived support within the study process. Research results revealed that several dimensions of the three multidimensonal factors play an important role in shaping the attitudes towards acceptance of ERP solutions by students.

Keywords: ERP solutions, TAM, economics and business' graduates, acceptance model

1. Introduction

The most widely used integrated solutions for business in companies from almost all industries worldwide are Enterprise Resource Planning (ERP) solutions. About 90 percent of the Fortune 500 companies use ERP solutions [1]. Number of ERP implementations and because of that also number of ERP users within organizations is growing very fast as well; employees are using ERP solutions daily at their work.

Therefore, it is not surprising that the research studies regarding adoptions and acceptance of ERP solutions by users at different levels within companies are emerging (for example [2]). The most frequently used research approaches in these studies are [3]: technology acceptance model (TAM) [4], theory of reasoned action (TRA) [5], theory of planned behaviour (TPB) [6], innovation diffusion theory (IDT) [7], stage model (SM) [8] and technology-environment-organization (T-O-E) [9]. In this area, TAM proved to be the most efficient model to study adoption in information systems (IS) ([2], [10] – [13]) and therefore numerous IS researchers apply this method to study ERP acceptance as well.

Because of that, there is also no doubt that the knowledge and skills of ERP solutions usage are among important competences of graduates in the field of economics and business, for achieving a competitive position in the labour market. In past few years, selected topics of ERP solutions have become an integrative part in curricula in the management and business studies, within courses, such as: Accounting Information Systems, Enterprise Resource Planning, Information Systems etc. On the other hand, all leading ERP vendors such as SAP, Microsoft, Oracle etc. have university academic alliances such as SAP University Alliances [14], Microsoft Dynamics Academic Alliance [15], Oracle University [16] etc. which help higher education institutions to use their ERP solutions in their curriculum and thus preparing students with hands-on experience in using modern business applications. Despite the recognized importance of the ERP solutions as a business management tool within companies and the importance of this knowledge for graduates, researches aimed at identification of factors shaping students' attitudes towards the acceptance of ERP solutions, are rather scarce ([17] - [20]).

The main objective of our paper is therefore the identification of important factors that contribute to the acceptance of ERP solutions by students in economics and business and that shape their intentions to use this knowledge in the future. The conceptual model of our research is based on TAM. The key purpose of TAM within our study is to provide a basis for testing the impact of additional external factors on students' internal beliefs (perceived usefulness - PU and perceived ease of use – PEOU), attitudes (AT), intentions (behavioural intention - BI) and actual use [21] (Davis et al., 1989) of the ERP solutions. Identified important multidimensional external factors refer to (1) students' personal characteristics and information literacy (PCIL), (2) perceived system and technological characteristics of ERP solutions (STC) and (3) perceived support within the study process (PSupport).

2. ERP Solutions

ERP solutions usually refer to the business-management support software. Typically, this is integrated applications which an organization can use to collect, store, manage and interpret data from their daily business activities. ERP solutions provide an integrated and continuously updated view of core business processes using common database. ERP solutions track business resources—cash, raw materials, production capacity—and the status of business commitments: orders, purchase orders, and payroll. The applications that make up the system share data across various departments (manufacturing, purchasing, sales, accounting, etc.) that provide the data [22]. ERP facilitates information flow between all business functions and manages connections to outside stakeholders [23]. Most ERP systems incorporate best practices which means the software reflects the vendor's interpretation of the most effective way to perform each business process [24].

The organization Gartner Group first defined ERP as a concept more than 25 years ago [25]. ERP systems initially focused on automating back office functions (functions which did not directly affect customers), while front office functions (functions which directly dealt with customers, e-business or supplier relationship management (SRM) became integrated later, when the Internet enabled the simplified communication with external parties. The organization Gartner Group [26] in year 2013 introduced the term "postmodern ERP" (some call it also extended ERP – xERP). According to Gartner's definition of the postmodern ERP strategy, legacy systems of monolithic and highly customized ERP suites, in which all parts are heavily inter-dependent, should be replaced by a mixture of both cloud-based and on-premise applications, which are more loosely coupled and can be easily exchanged if needed. The organization Gartner Group has evolved its definition over time and now defines ERP as an application strategy focused on several distinct enterprise application suite markets. They segment ERP into four major business process support areas: financial management systems, human capital management (HCM), enterprise assets management (EAM), and manufacturing and operations [25]. Early ERP providers focused on large enterprises, but smaller enterprises are increasingly using ERP systems as well. The worldwide ERP market grew from 3.8% and 24.4B USD in 2012 to 25.4B USD in 2013. The global ERP software market is projected to reach $47.71 billion by 2022 growing at a CAGR of 7.0% during the forecast period (2016 to 2022). Company SAP is in market leadership position, follow by Oracle, Sage, Infor and Microsoft [27]. It is expected that ERP will remain the basic important software in the organisations.

3. Literature Review

Several theoretical approaches have been used to investigate the determinants of acceptance and the use of new information technology (IT), such as the theory of reasoned action (TRA) [5], the theory of planned behaviour (TPB) [6], the theory of the technology acceptance model (TAM) [4], [21], innovation diffusion theory (IDT) [7], stage model (SM) [8] and technology-environment-organization (T-O-E) [9].

Compared to competing models, TAM is believed to be more parsimonious, predicative, and robust [28] - [30], and therefore it is most frequently used by IS/IT researchers [2], [4], [21], [31] – [32]. TAM posits that two beliefs − perceived usefulness (PU) and perceived ease of use (PEOU) − are of primary relevance for computer acceptance behaviour [21]. PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [4]. PEOU in contrast, refers to "the degree to which a person believes that using a particular system would be free of effort" [4]. 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 behavioural intention (BI) to use it. Finally, intention is positively related to the actual use (U). TAM also predicts that PEOU influences PU, as Davis et al. [21] put it, "effort saved due to the improved perceived ease of use may be redeployed, enabling a person to accomplish more work for the same effort". The key purpose of TAM is to provide a basis for identifying the impact of external factors on internal beliefs, attitudes, and intentions [21]. Original TAM is presented in Figure 1 by the grey rectangle. The original TAM is well established and tested and furthermore, a variety of extensions regarding external factors for examining the antecedents of PU and PEOU have been developed such as TAM 2 [28], UTAUT [33] and TAM 3 [34].

Even though TAM can be applied to a variety of technologies, the extensions and modifications of TAM are needed when analysing specific information systems [35]. Although the number of studies analysing the acceptance of ERP solutions by users in companies are emerging, they are still scarce and most of them investigate a very limited number of specific external factors [2], [10] – [13], [20], [32], [35] – [38]. The researches aimed at analysing factors influencing the ERP solution acceptance by students are even more scarce (see [18] – [20]). Shivers-Blackwell and Charles [18] researched student readiness to use ERP technology using TAM, but they studied students' ERP acceptance in specific circumstances, namely, students read an online newsletter provided by the ERP communication, education, and training team entitled "What is ERP", first. Participants were then solicited by their professors to complete the survey, without any practical experience of ERP solution usage. Scott and Walczak [19] examined cognitive engagement, prior experience, computer anxiety, and organizational support as determinants of computer self-efficacy in the use of a multimedia ERP system's training tool. They also examined the impact of computer self-efficacy on its acceptance. Iriberri [20] researched the external factors' impact - training and teaching - on actual use.

4. Conceptual Model And Hypotheses

The main objective of our research is to identify the factors, included into the extended TAM as external factors, that are significantly shaping the antecedents of students' attitudes and future intentions of students to use the ERP solutions.

As already mentioned, the TAM introduced by Davis [4] and Davis et al. [21], suggests the following relationships (this original TAM is presented by grey rectangle in Figure 1) among the multidimensional constructs, that are perceived ease of use –

PEOU, perceived usefulness – PU, attitude toward using ERP system – AT, behaviour intention – BI, actual use – Use and in the case of our research refer to the ERP solutions:

- 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).
- H4: Attitude toward ERP system (AT) has positive and direct effect on behaviour intention (BI).
- H5: Behaviour intention (BI) has positive and direct effect on actual use (Use).

Even though TAM can be applied to a variety of technologies, it must be extended and modified for analysis of specific information systems [35], as we already pointed out. The literature review revealed that the external factors in general can be divided into three groups of factors: personal characteristics and information literacy (PCIL), system and technological characteristics (STC), and organizational-process characteristics (OPC) (see [11] – [13]).

Personal characteristics and information literacy (PCIL), including personal characteristics that can influence individuals' perceptions of ERP system acceptance and usage, were analysed in the past: personal innovativeness from the IT view-point [39] – [40], computer anxiety [33], computer self-efficiency [10], [28], [33] and perceived individual benefits [41].

In contrast to most researches regarding IT implementation which are very wide, the fact that ERP implementation research is focused on single technology-software solution, implies that the specific perceived technological characteristics should be examined. The literature review suggests that the following external factors are important within STC: system performance [33], [42], user manuals (help) [42] – [43], quality of ERP system [2] and quality of information in ERP system [41].

In the conceptual model of our research the modifications were implemented within the OPC construct, since the environment within the higher education institutions differs from the business environment in companies. Organizational-process characteristics (OPC) capture various social processes, mechanisms, and support organizations that guide individuals to facilitate the use of an ERP system. Since the students' acceptance of ERP solutions is in the focus of our research, the factors associated with their perceived support within the study process (during course lectures and exercises regarding ERP solution) were considered; therefore, the OPC construct was reshaped with the purpose to cover the educational organization view point. PSupport – Perceived support within study process includes perceived social influence (of teachers, other students and professionals participating in the educational process) [33] and perceived characteristics of training and education on ERP system [11], [31], [44].

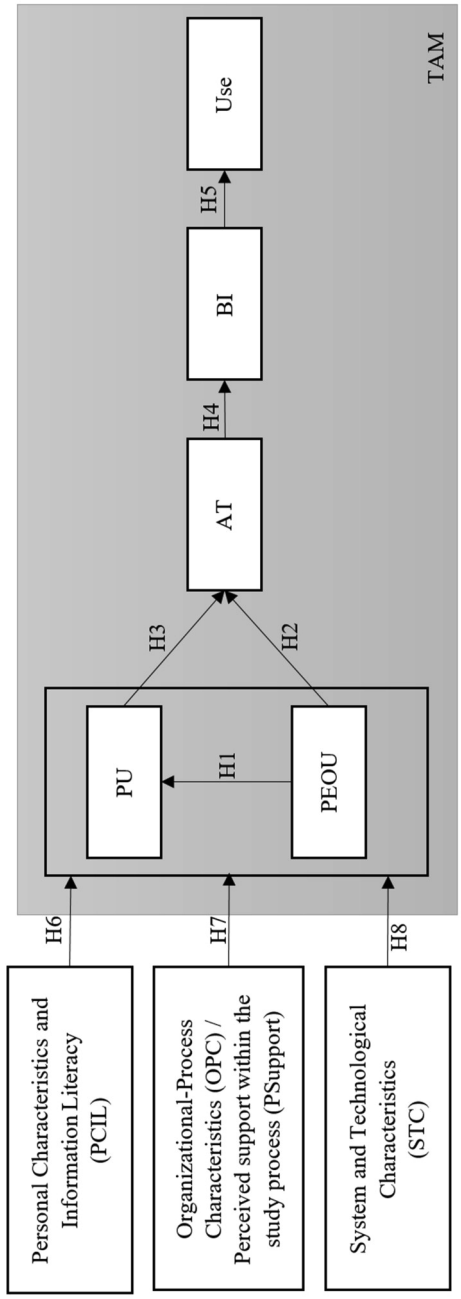

Figure 1. Conceptual Model

Therefore, the following hypotheses were formed:

H6: Personal characteristics and information literacy (PCIL) has a positive impact on the perceived ERP usefulness (PU).

H7: Perceived support within the study process (PSupport) has a positive impact on the perceived ERP usefulness (PU).

H8: Perceived system and technological characteristics (STC), has a positive impact on perceived ERP ease of use (PEOU).

5. Research Design And Methodology

The questionnaire was developed in three phases. In the first phase, we clarified the relationships between the constructs and the measurement scales for individual constructs, we reviewed the literature and resources. A questionnaire was employed. All items in the questionnaire were scored on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The research design consisted of five constructs arising from the TAM model (PEOU, PU, AT, BI and Use) and three multidimensional external constructs (PCIL, STC and PSupport), that we formed and included into the expanded TAM model. The external factors are therefore included by the three second-order constructs, based on all manifest variables of the underlying lower-order factors. PCIL includes: personal innovativeness toward IT, computer anxiety, perceived computer self-efficiency and perceived individual benefits. STC is composed of: system performance, user manuals (help), quality of ERP system and quality of information in ERP system. PSupport includes: perceived social influence (of teachers, other students and professionals participating in the educational process) and perceived characteristics of training and education on ERP system. Our conceptual model includes 15 first-order factors and 3 second-order factors.

In the second phase the instrument was pilot tested with a group of 30 ERP users in an organization. Based on the results of the pilot testing, revisions and additions were made to the instrument.

In the third phase the survey was conducted. Our sample included a total of 172 Croatian students in the second (4th semester) year of undergraduate study programme "Economics of entrepreneurship". The survey was carried out at the end of semester after students' full interaction with Microsoft Dynamics NAV ERP solution, within the course that includes all together 30 teaching hours of lectures of ERP topics with focus on selecting and implementing IS in methodological way and 30 hours in computer lab where students adopt the knowledge of the business processes functions in Microsoft Dynamics NAV (introduction, basic in finance and accounting process, purchasing process, sales process and some advance functionality simulating every day activities). The Microsoft Dynamics NAV 2016 (NAV) was used.

The empirical data was analysed in four stages involving PLS technique, using SmartPLS 3 [45]. Partial least squares (PLS) approach can be employed to estimate the parameters of a hierarchical model and allows the conceptualisation of higher-order factors through the repeated use of manifest variables [46]. A higher-order factor can thus be created by specifying a latent variable which represents all the manifest variables of the underlying lower-order factors. PLS path modelling is widely used in business and social sciences [47]. We employed a PLS approach because of the

relatively small number of samples of valid data and our desire to analyse second-order factors.

In the first stage, measurement model was assessed. Second stage is focused on hypothesis testing. Path significance has been estimated using bootstrapping resampling technique with 500 sub-samples as suggest [45]. Third stage include blindfolding procedure. The purpose of it is to calculate cross-validated measures of model predictive accuracy (reliability). And fourth stage includes importance-performance map analysis (IPMA), which in a different way presents path information [48]. Standard PLS analyses provide information on the relative importance of constructs and explaining other constructs in the structural model. The IPMA extends the results of PLS by also taking the performance of each construct into account [45]. While analysing data, we followed the guidelines specified by Henseler et al. [47] and Garson [48].

6. Results And Analysis

6.1 Descriptive Statistics

172 questionnaires were properly filled and used for analysis, 15.70 % (27) male and 84.30 % (145) female. The average age of students was 20.70 years. In this research was included two generation of students. On the last lecture in the semester (June 2017) 87 questionnaires were properly filled out by respondents. Respondents were 14.9% (13) male and 85.1% (74) female. The average age of students was 20.70 years. On the last lecture in the semester (June 2018) 85 questionnaires were properly filled out by respondents. Respondents were 16.5% (14) male and 83.5% (71) female. The average age of students was 20.69 years. Demographic data were analysed by SPSS.

6.2 Measurement Model

All measurement scales were examined for their psychometric properties (reliability, convergent validity, and discriminant validity) prior to testing hypotheses (bootstrapping with 500 subsamples). For external factors second-order method (also known as the method of repeated indicators) purposed by Wold [49] was used. While external factor computer anxiety did not meet assessment requirements of the measurement model, it was excluded from further analysis. The final version of the model is present.

The first criterion is internal consistency reliability, which can be examined by Cronbach's alpha (α) and composite reliability (CR), where value below 0.6 indicates a lack of reliability [47]. As shown in Table 1 each of our 14 factors had value above 0.6, except external factor social influence, which had Cronbach's α 0.57 and CR 0.58, which is acceptable scale for exploratory purpose [48]. All factors accept one assuring adequate reliability for confirmatory purposes.

For assessment of validity, two validity subtypes are usually used: the convergent validity and the discriminant validity. For convergent validity Fornell and Larcker's

assessment criteria has been used: the average variance extracted (AVE) for each construct should exceed 0.50 [50] – [51]. They added that AVE of at least 0.5 meaning that a latent variable can explain more than half of the variance of its indicators on average. All values AVE exceeded 0.50. All factors loadings are significant at $p<0.01$ and almost all exceed 0.70, except three indicators which exceed 0.68 (see Table 1). In Table 4 and Figure 2 shows the loadings of the first-order factors on second-order factors, which exceed 0.70, except two indicators which exceeded 0.48 and 0.53 and are significant at $p<0.01$. Values AVE are or exceed 0.50. Our measurement scales meet the criteria for convergent validity.

Factor	Items	M	SD	Loadings	α	CR	AVE
Personal Innovativeness toward IT	V111	3.86	1.55	0.89	0.68	0.86	0.76
	V112	3.29	1.58	0.85			
Computer self-efficiency	V131	4.51	1.75	0.88	0.70	0.87	0.77
	V132	4.72	1.50	0.87			
Individual benefits	V151	4.63	1.63	0.79	0.94	0.95	0.81
	V152	4.76	1.63	0.93			
	V153	5.14	1.57	0.94			
	V154	5.16	1.47	0.95			
	V155	5.30	1.57	0.88			
System performance	V221	4.88	1.63	0.87	0.74	0.85	0.66
	V223	5.27	1.44	0.84			
	V225	3.90	1.77	0.72			
User Manuals	V232	4.58	1.29	0.84	0.68	0.86	0.75
	V233	4.39	1.64	0.90			
Quality of ERP system	V241	4.80	1.37	0.79	0.90	0.92	0.67
	V242	4.80	1.40	0.85			
	V243	4.78	1.46	0.88			
	V244	4.16	1.61	0.83			
	V245	4.60	1.40	0.87			
	V246	4.95	1.53	0.68			
Quality of information in ERP system	V251	5.06	1.33	0.68	0.85	0.89	0.63
	V252	5.27	1.46	0.74			
	V253	5.13	1.46	0.87			
	V254	4.58	1.57	0.83			
	V255	4.87	1.48	0.83			
Social influence	V323	4.52	1.50	0.82	0.57	0.82	0.70
	V325	5.20	1.50	0.86			
Training and education on ERP system	V341	4.91	1.51	0.73	0.87	0.90	0.56
	V342	5.06	1.48	0.75			
	V343	4.98	1.54	0.82			
	V344	5.26	1.64	0.73			
	V345	3.43	1.67	0.75			
	V346	3.31	1.65	0.69			
	V347	4.41	1.71	0.78			
Perceived ERP usefulness (PU)	V411	4.84	1.47	0.90	0.93	0.95	0.82
	V412	4.90	1.35	0.92			
	V413	4.58	1.63	0.92			
	V414	4.56	1.66	0.89			
	V421	3.74	1.68	0.93	0.92	0.94	0.80

Perceived ERP ease of use (PEOU)	V422	3.48	1.73	0.90			
	V423	3.04	1.77	0.85			
	V424	3.56	1.76	0.90			
Attitude toward using ERP (AT)	V441	4.87	1.57	0.76	0.78	0.87	0.69
	V442	4.26	1.77	0.87			
	V443	3.66	1.80	0.86			
Behaviour intention (BI)	V451	3.55	1.85	0.91	0.92	0.95	0.86
	V452	3.82	1.78	0.94			
	V453	3.74	1.72	0.93			
Use	V531	3.56	1.56	0.90	0.88	0.93	0.81
	V532	3.50	1.53	0.92			
	V533	3.39	1.64	0.86			

Table 1: Descriptive statistics and psychometric properties of measures (n= 172)

AVE is used to establish discriminant validity by the Fornell and Larcker [50] criterion. The square root of AVE should be higher than its correlation with any other latent variable. In Table 2, we can see, that the square root of AVE appears in the diagonal cells are higher than correlations, which appear below it. The standardized root mean square residual (SRMS) is measure of approximate fit of the researcher's model [48]. It measures the difference between the observed correlation matrix and the model. Model has good fit when SRMS is less than 0.10. SRMR of our composite model is 0.097, which means that model is acceptable.

In well-fitting model, heterotrait correlations should be smaller than monotrait correlations, meaning that the heterotrait-monotrait (HTMT) ratio should be below 1.0 [48], with lower SRMS being better fit. Table 2 shows that all values are below 0.93.

	01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**
01 PI	0,87													
02 CS	0,29 *0,42*	0,88												
03 IB	0,32 *0,40*	0,27 *0,33*	0,90											
04 SP	0,24 *0,34*	0,21 *0,30*	0,63 *0,76*	0,81										
05 UM	0,20 *0,30*	0,11 *0,15*	0,55 *0,69*	0,65 *0,93*	0,87									
06 QS	0,32 *0,41*	0,34 *0,42*	0,67 *0,73*	0,74 *0,89*	0,68 *0,85*	0,82								
07 QI	0,30 *0,39*	0,22 *0,28*	0,59 *0,66*	0,60 *0,75*	0,59 *0,76*	0,71 *0,81*	0,79							
08 SI	0,18 *0,32*	0,21 *0,34*	0,49 *0,67*	0,32 *0,48*	0,26 *0,39*	0,48 *0,67*	0,47 *0,67*	0,84						
09 TE	0,29 *0,38*	0,25 *0,32*	0,65 *0,72*	0,58 *0,73*	0,61 *0,79*	0,66 *0,75*	0,68 *0,79*	0,58 *0,81*	0,75					
10 PU	0,29 *0,36*	0,28 *0,35*	0,74 *0,80*	0,62 *0,75*	0,62 *0,77*	0,69 *0,75*	0,65 *0,73*	0,52 *0,71*	0,77 *0,86*	0,91				
11 PEOU	0,19 *0,23*	0,16 *0,19*	0,49 *0,51*	0,53 *0,63*	0,54 *0,66*	0,56 *0,60*	0,42 *0,45*	0,29 *0,40*	0,60 *0,66*	0,62 *0,65*	0,90			

12	0,28	0,22	0,62	0,50	0,48	0,60	0,48	0,44	0,64	0,73	0,72	0,83		
AT	*0,38*	*0,30*	*0,73*	*0,66*	*0,65*	*0,71*	*0,59*	*0,67*	*0,79*	*0,85*	*0,83*			
13	0,28	0,24	0,58	0,48	0,40	0,53	0,38	0,40	0,57	0,66	0,72	0,80	0,93	
BI	*0,36*	*0,30*	*0,62*	*0,60*	*0,51*	*0,58*	*0,43*	*0,57*	*0,64*	*0,72*	*0,77*	*0,94*		
14	0,18	0,13	0,47	0,48	0,47	0,45	0,41	0,27	0,45	0,54	0,57	0,58	0,56	0,90
Use	*0,23*	*0,16*	*0,51*	*0,60*	*0,60*	*0,50*	*0,47*	*0,39*	*0,51*	*0,60*	*0,63*	*0,68*	*0,62*	

Table 2: Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (*HTMT in italic*)

5.3 Structural model

The structural model was examined to test hypotheses. Paths are interpreted as standardised beta weights in a regression analysis. The relationships testing results are based on bootstrapping (with 500 subsamples) to test the statistical significance of each path coefficient using t-tests, as recommended by Chin [52].

Our research confirms results of original TAM. All relationships in original TAM are statistically significant as shown in Table 3 and Figure 2. Perceived ERP ease of use (PEOU) has weak but significant effect on perceived ERP usefulness (PU) (β = 0.169, p<0.01) and moderate significant effect on attitude toward using ERP system (AT) (β = 0.445; p<0.01). Perceived ERP usefulness (PU) has moderate significant effect on attitude toward using ERP system (AT) (β = 0.451; p<0.01). Attitude toward using ERP system (AT) very strong influences on behaviour intention (BI) (β = 0.803; p<0.01) and behaviour intention (BI) has moderate significant effect on actual use (Use) (β = 0.564; p<0.01).

Relationship	***β*-coefficient**	***t*-statistics**	f^2
PEOU → PU	0.17	3.23**	0.06[a]
PEOU → AT	0.45	6.54**	0.35[b]
PU → AT	0.45	6.69**	0.35[b]
AT → BI	0.80	28.29**	1.81[c]
BI → Use	0.56	8.90**	0.46[c]
PCIL → PU	0.29	4.67**	0.16[b]
STC → PEOU	0.33	3.19**	0.08[a]
STC → PU	0.19	2.45*	0.05 [a]
PSupport → PEOU	0.35	3.342**	0.09 [a]
PSupport → PU	0.34	5.20**	0.16 [b]

Note: ** 0.01 of significance; * 0.05 of significance; n.s. not significant.
[a] small (> 0.02), [b] medium (>0.15), [c] large (>0.35)

Table 3: The structural model was examined to test the hypotheses. (500)

We also wanted research impact of external factors through second-order factors on original TAM. We can confirm, that nine external factors through three second-order factors have large impact on PU and PEOU and further on AT, BI and Use. As it can be seen from Table 1, the loadings of the first-order factors on the second-order factors exceed 0.7 and second-order factors have significant positive effect on PU and on PEOU. Second-order factors (PCIL, PSupport and STC) have significant positive effect on perceived ERP usefulness (PU) and on perceived ERP ease of use (PEOU) (see Table 4 and Figure 2).

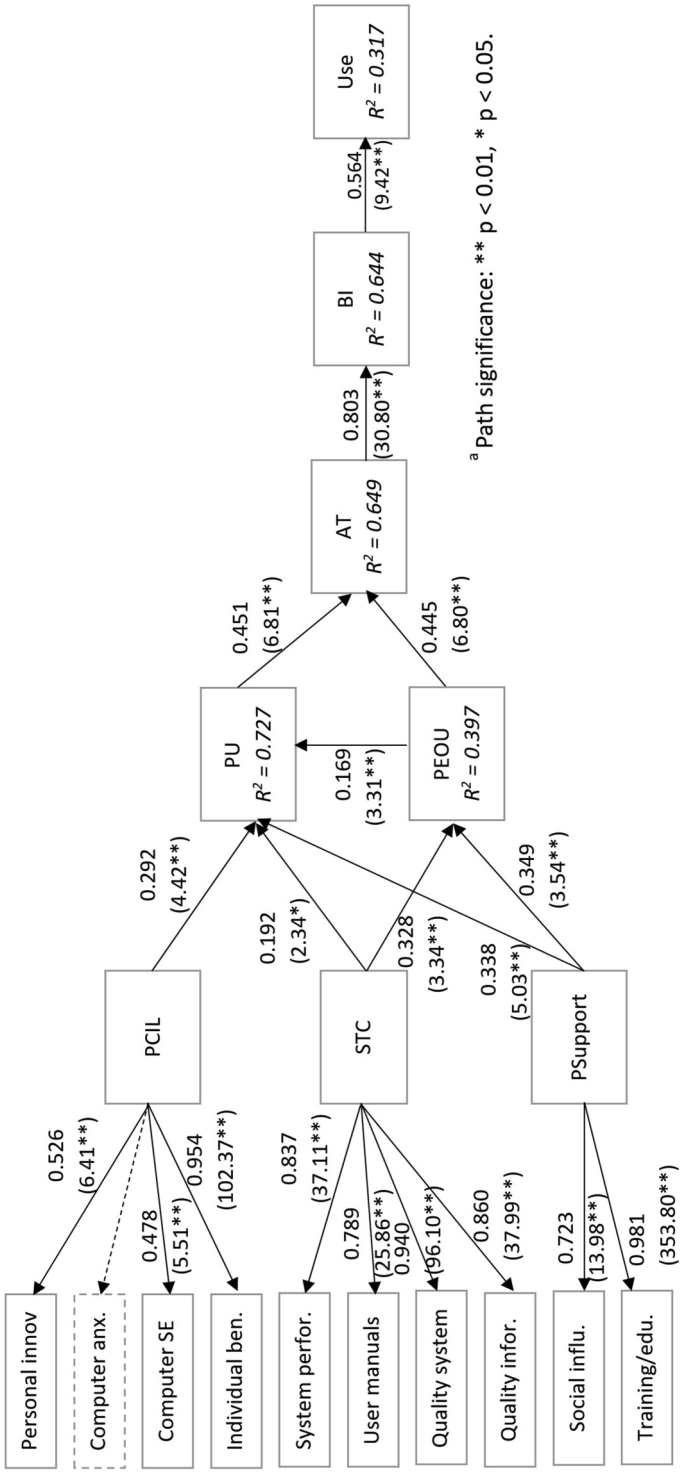

Figure 2: Results of structural model analysis

PCIL has a weak positive effect on perceived ERP usefulness (PU) (β = 0.292, p<0.01). PSupport has a weak but significant effect on perceived ERP usefulness (PU) (β = 0.338, p<0.01) and PEOU (β = 0.349, p<0.01). STC has weak significant effect on perceived ERP ease of use (PEOU) (β = 0.328, p<0.01) and weaker significant effect on perceived ERP usefulness (PU) (β = 0.192, p<0.01).

First –order factor	**PCIL** α = 0.85 *CR* = 0.89 *AVE*=0.50	**STC** α = 0.94 *CR* = 0.94 *AVE*=0.51	**PSupport** α = 0.87 *CR* = 0.90 *AVE*=0.50
Personal innovativeness	0.53 (6.49)		
Computer self-efficiency	0.48 (5.18)		
Individual benefits	0.95 (98.58)		
System performance		0.84 (38.51)	
User manuals		0.79 (26.64)	
Quality system		0.94 (100.64)	
Quality information		0.86 (38.13)	
Social influence			0.72 (13.53)
Training/education			0.98 (334.26)

Note: All *t*-values are bigger then 2.58 and are significant at p<0.01.

Table 4: Path coefficients of first-order factors on second-order factors

The R^2 indicates the exploratory power or variance explained of the latent endogenous variable and it is the most common effect size measure in path models [48]. The external variables could explain 72.7 percent variance in PU (R^2 = 0.727) and 39.7 percent variance in PEOU (R^2 = 0.397). PU and PEOU together explain 64.9 percent of the variance in AT (R^2 = 0.649). The AT explain 64.4 percent of variance in BI (R^2 = 0.644) and BI explain 31.7 percent of Use (R^2 = 0.317) (Table 1 and Figure 2).

For each effect in the path model, we can evaluate the effect size by means of Cohen's f^2 [47], [53]. The effect size f^2 is calculated as the increase in R^2 relative to the proportion of variance of the endogenous latent variable that remains unexplained. According to Cohen [53], f^2 values of 0.02, 0.15 and 0.35 signify small, medium, and large effects, respectively. Average f^2 value is 0.357, which indicate large effect size and the effect of dropping any of the factors from the model is large.

6.4 Blindfolding procedure

We also examine Stone-Geisser's Q^2 value as criterion of predictive relevance. The blindfolding approach proposed by Wold [49] was used. It utilizes a cross-validation (cv) strategy and reports cv-communality and cv-redundancy for constructs as well as indicators. The cv-communality index (H^2) measures the quality of the measurement model, where the cv-redundancy index (i.e. Stone-Geisser's Q^2) measures the quality of the structural model. The H^2 has been described as a cv-R^2 between the block

manifest variables and their own latent variable [46]. The cv-communality measures the capacity of the path model to predict the manifest variables directly from their own latent variable by cross-validation. It uses only the measurement model. The quality of each structural equation is measured by the cv-redundancy index (Q^2). Q^2 is define as cv-R^2 between the manifest variables of an endogenous latent variable and all the manifest variables associated with the latent variables explaining the endogenous latent variable, using the estimated structural model. More specifically, it measures the capacity of the path model to predict the endogenous manifest variables indirectly form a prediction of their own latent variable using the related structural relation by cross-validation [46]. The means of the various Q^2 related to the endogenous blocks can be used to measure the global quality of the structural model, if they are positive for all endogenous blocks. A H^2 and Q^2 values above 0 indicates that the measurement model and structural model is relevant for predicting [48]. As shown in Table 5, the measurement model (H^2=0.500) shows a little better quality than the structural one (Q^2=0.403). Following Cohen [53], 0.02 represents a small effect size, 0.15 represents a medium effect size, and 0.35 represents a high effect size. Measurement model and structural model are having a high degree of predictive relevance.

Construct	R^2	H^2	Q^2
PU	0.727	0.636	0.552
PEOU	0.397	0.614	0.287
AT	0.649	0.371	0.421
BI	0.644	0.623	0.521
Use	0.317	0.548	0.235
OPC	-	0.370	-
PCIL	-	0.386	-
STC	-	0.425	-
Average	0.548	0.500	0.403

Table 5: Values of predictive accuracy ($R,^2$ cv-communality (H^2), cv-redundancy (Q^2) indexes)

6.5 The importance-performance map analysis (IPMA)

The IPMA is useful for generating additional findings and conclusions by combining the analysis of the importance and performance dimensions in practical PLS-SEM applications [54]. It uses different way of presenting path information and shows direct determination of the relative importance of constructs (latent variables) in the PLS model [48]. IPMA allows prioritize areas requiring improvement. As a result, areas with relatively high importance and relatively low performance may be identified and improved upon appropriate management activities. Ringle and Sarsted [54] and Garson [48] procedure was following to calculate IPMA. Table 6 and Figure 3 shows the importance and performance of the factors for the endogenous target factor of Use. The factors in descending order of importance are BI, AT, PEOU, PU, OPC, STC and PCIL. However, the factors in descending order of performance are PU, STC, PCIL, OPC, AT, BI and PEOU. It can be seen, that the performance of BI and PEOU do not match their importance. Consequently, teachers' activities to

increase the Use should focus on the construct of BI and PEOU, which can be achieved by focusing on the predecessor of factors STC and PSupport.

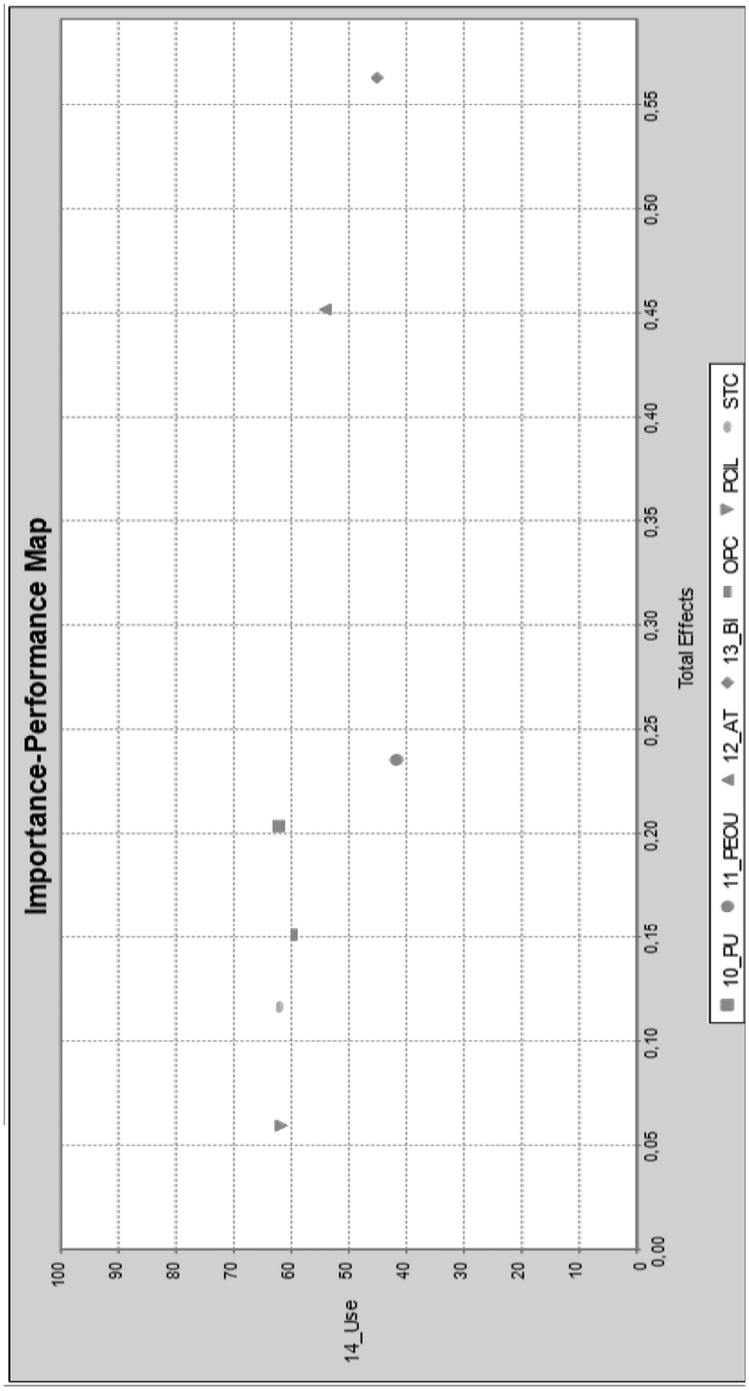

Figure 3: The importance-performance map (IPMA) for factor Use

	Importance	Performances
PU	0,20	62.15
PEOU	0,24	41.71
AT	0,45	54.10
BI	0,56	45.07
OPC	0,15	59.49
PCIL	0,06	61.69
STC	0,12	62.06
Mean value	0.25	55.18

Table 6: The importance-performance map (IPMA) for factor Use

7. Discussions

Results of the present study regarding the hypotheses of original TAM model are consistent with several other research results regarding the IT/IS acceptance [4], [21], etc. Both, PEOU and PU have strong positive effect on ERP use, with the relationship of PU being a bit stronger. Also, PEOU has small statistical effect on PU. Therefore, hypothesis H1, H2 and H3 were confirmed. The findings about the importance of PEOU and PU in the literature are vague; Davis [4], Davis et al. [21] and Simon and Paper [55] exposed that PU has stronger positive effect on IT/IS usage as PEOU, while PEOU has weaker or even no statistical effect on IT/IS usage after some time of usage. Since students were surveyed at the end of semester, where the ERP solution learning process took place, this could be the reason for the weak strength of PEOU on PU. Factor AT is vital in the TAM model and has very strong positive effect on BI and through it also indirect strong positive effect on Use, which is consistent with other researches [55] – [56]. Hypotheses H4 and H5 were confirmed.

The main result of this research is the identification of external factors which influence students' ERP acceptance and have an impact on the antecedents of PU and PEOU. The second order factor PCIL had significant and positive impact on the (see Figure 2). Therefore, hypothesis H6 was confirmed. The first-order factors within PCIL – namely personal innovativeness toward IT (software tools and applications), computer self-efficiency and individual benefits - had significant impact on PU, but not on PEOU. First-order factor Computer anxiety, is not statistically significant – this can be explained by the fact that the computer anxiety is probably a state of fear that is not known any more to the young population who grew up with the computers included in all (or at least many) aspects of every day's life.

The fact that ERP implementation research is focused on a single solution (technology) has enabled the possibility to study specific perceived system and technological characteristics. In the past, this external second-order factor (STC) was included into the research models of very few previous researchers [11] – [13]. Factor STC was showing a statistically significant impact on PU and on PEOU, through the following first-order external factors: system performance, user manuals, quality of

ERP system and quality of information in ERP system. Therefore, hypothesis H8 was confirmed.

Second order factor PSupport has significant positive impact on PU and PEOU. This two relationships support hypothesis H7. This factor was showing statistically significant impact on PEOU and PU through two first-order factors: social influence and training and education. Factor social influence concerns opinions of teachers, other students and professionals participating in the educational process regarding students' knowledge of ERP systems. It seems that students consider the opinions of other (important) people for them. From Figure 2 we can see, that the most important external factor is factor training and education. Therefore, we suggest teachers to put an important effort into the preparation of excellent teaching materials and that try to explain ERP topics related content to students using simple routines, with the real business environment characteristics. To understand the ERP solutions is challenging for students, because they do not have practical experience of how ERP solutions are used in enterprises.

On the bases of IPMA teachers can improve students' ERP usage (Use) through factor PEOU and their second order factors STC and PSupport. From group these two second-order factors, most important external factor is training and education (from PSupport), followed by quality of system, quality of information and system performance (from STC).

8. Conclusion

The aim of this research was to identify which external factors have impact on students 'acceptance of ERP within study programme, while they are exposed to ERP solution (in our case Microsoft Dynamics NAV). We want to know how to motivate students to take course dealing with the ERP solution Microsoft Dynamics NAV, with all due seriousness and importance. That is why we studied 10 external factors which might have an impact on students' ERP acceptance. Studying the influence of the system of external factors on constructs not only contributes to the theory development, but also helps in designing teachers' curriculum.

Our research shows that most important external factors are especially two: training and education about ERP and individual benefits (where students see knowledge of ERP to enhance their productivity and effectiveness in the job, has positive effect on their future career etc.). Factor training and education about ERP is more important than factor social influence. Therefore, teachers must put an important effort into the preparation of excellent teaching materials and that try to explain ERP topics related content to students using simple routines.

External first order factors within PCIL, namely personal innovativeness toward IT (software tools and applications), computer self-efficiency and individual benefits (regarding future job), were important personal factors, while computer anxiety was not important. Among important first order factors of STC were all four: system performance, user manuals, quality of ERP system and quality of information in ERP system.

Several implications for researchers and practitioners arise from the results of the extended version of TAM, especially regarding the training and education characteristics, as already explained in the previous chapter.

This study has certain limitations which are at the same time the opportunities for further research within this important and comprehensive topic. Since the respondents were limited to one group of students in Croatia, the study could be extended to other countries. Further research is needed to explore the importance of external factors included in different time frames (after introduction of course, at the end of course) as well as inclusion of additional external factors. Another limitation is also that research was conducted for one ERP solution only –namely for Microsoft Dynamics NAV; the importance of external factors may be different, when other ERP solutions are taking place (SAP, Infor ERP etc.).

Acknowledgements

This research was partially supported by the Slovenian Research Agency (research core funding No. P5-0023).

References

[1] HubPages, "Enterprise Resource Planning (ERP) and Fortune 500 Companies," 2017. [Online]. Available: https://hubpages.com/business/Enterprise-Resource-Planning-ERP-and-Fortune-500-Companies [Accessed July 18, 2018].

[2] C. Costa, E. Ferreira, F. Bento, and A. Aparicio, "Enterprise resource planning adoption and satisfaction determinants," *Computers in Human Behaviour*, vol. 63, pp. 659–671, 2016.

[3] H. O. Awa, O. Ukoha, and B. C. Emecheta, "Using T-O-E theoretical framework to study the adoption of ERP solution," *Cogent Business & Management*, vol. 3, pp. 1–23, 2016.

[4] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989.

[5] M. Fishbein and I. Ajzen, *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Reading, MA: Addison-Wesley, 1975.

[6] I. Ajzen, "The theory of planned behaviour," *Organizational Behaviour and Human Decision Processes*, vol. 50, pp. 179–211, 1991.

[7] E. Rogers, *Diffusion of Innovations* (4th ed.). New York: The Free Press, 2003.

[8] S. Poon and P. Swatman, "An exploratory study of small business internet commerce issues," *Information & Management*, vol. 35, no. 1, pp. 9–18, 1999.

[9] L. Tornatzky and M. Fleisher, *The process of technology innovation.* Lexington: Lexington Books, 1990.

[10] Y. Y. Shih and S. S. Huang, "The actual usage of ERP systems: An extended technology acceptance perspective," *Journal of Research and Practice in Information Technology*, vol. 41, no. 3, pp. 263–276, 2009.

[11] S. Sternad Zabukovšek, M. Gradišar, and S. Bobek, "The influence of external factors on routine ERP usage," *Industrial management + data systems*, vol. 111, no. 9, pp. 1511–1530, 2011.

[12] S. Sternad and S. Bobek, "TAM-based external factors related to ERP solutions acceptance in organizations," *International Journal of Information Systems and Project Management*, vol. 1, no. 4, pp. 25–38, 2013.

[13] S. Sternad and S. Bobek, "Comparative analysis of acceptance factors for SAP and Microsoft Dynamics NAV ERP solutions in their maturity use phase: enterprise 2.0 issues," in *Handbook of research on enterprise 2.0: technological, social, and organizational dimensions*, M.M. Cruz-Cunha, F. Moreira, and J. Varajao, Eds. Hershey, New York: Business Science Reference, IGI Global, 2014, pp. 389–415.

[14] SAP, "SAP University Alliances," 2018. [Online]. Available: https://www.sap.com/training-certification/university-alliances.html. [Accessed May 20, 2018].

[15] Microsoft, "Microsoft Dynamics Academic Alliance," 2018. [Online]. Available: https://dynamics.microsoft.com/en-us/academic/. [Accessed May 20, 2018].

[16] Oracle, "Oracle University," 2018. [Online]. Available: http://education.oracle.com/pls/web_prod-plq-dad/db_pages.getpage?page_id=3. [Accessed May 20, 2018].

[17] C. H. Davis and J. Comeau, "Enterprise Integration in Business Education: Design and Outcomes of a Capstone ERP – based Undergraduate e-Business Management Course," *Journal of Information Systems Education*, vol. 15, no. 3, pp. 287-300, 2004.

[18] S. L. Shivers-Blackwell and A. C. Charles, "Ready, set, go: Examining student readiness to use ERP technology," *Journal of Management Development*, vol. 25, no. 8, pp. 795–805, 2006.

[19] J. E. Scott and S. Walczak, "Cognitive engagement with a multimedia ERP training tool: Assessing computer self-efficacy and technology acceptance," *Information & Management*, vol. 46, pp. 221–232, 2009.

[20] A. Iriberri, "Integrating an ERP into the curriculum at a business school: the students' perceptions of SAP," *Academy of Education Leadership Journal*, vol. 19, no. 2, pp. 99- 108, 2015.

[21] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User acceptance of computer technology: A comparison of two theoretical models," *Management Science*, vol. 35, no. 8, pp. 982–1003, 1989.

[22] D. A. Almajali, R. Masa'deh, and A. Tarhini, "Antecedents of ERP systems implementation success: a study on Jordanian healthcare sector," *Journal of Enterprise Information Management*, vol. 29, no. 4, pp. 549–565, 2016.

[23] H. Bidgoli, *The Internet Encyclopaedia*, Volume 1. New Jersey: John Wiley & Sons, Inc, 2004.

[24] E. Monk and B. Wagner, *Concepts in Enterprise Resource Planning,* 3rd.ed. Massachusetts: Course Technology Cengage Learning Boston, 2009.

[25] N. Montgomery, R. P. Anderson, J. Kostoulas, and A. Woodyer, "High-Tech Tuesday Webinar: Best Opportunities and Bets for Growth in Enterprise Resource Planning," May, 2018. [Online]. Available: https://www.gartner.com/doc/3640429?ref=SiteSearch&sthkw=postmodern%20erp&fnl=search&srcId=1-3478922254. [Accessed May 20, 2018].

[26] D. Ganly, A. Kyte, N. Rayner, and C. Hardcastle, "Predicts 2014: The Rise of the Postmodern ERP and Enterprise Applications World," Gartner Group, 2013. [Online]. Available: https://www.gartner.com/doc/2633315/predicts--rise-postmodern-erp. [Accessed March 10, 2017].

[27] SMRC, "ERP Software Market Report 2017, Trends, Analysis, Share, Estimates and Forecasts to 2022," Statistics Market Research Consulting, 2017. [Online]. Available: http://www.mynewsdesk.com/us/pressreleases/erp-software-market-report-2017-trends-analysis-share-estimates-and-forecasts-to-2022-2287038. [Accessed June 5, 2018].

[28] V. Venkatesh and F. D. Davis, "A theoretical extension of the technology acceptance model: Four longitudinal field studies," *Management Science,* vol. 46, no. 2, pp. 186–205, 2000.

[29] J. Lu, Y. Chun-Sheng, C. Liu, and J. E. Yao, "Technology acceptance model for wireless internet," *Internet Research: Electronic Networking Applications and Policy*, vol. 13, no. 3, pp. 206–222, 2003.

[30] L. Liu and Q. Ma, "Perceived system performance: A test of an extended technology acceptance model," *Journal of Organizational and End User Computing*, vol. 18, no. 3, pp. 1–24, 2006.

[31] K. Amoako-Gyampah and A. F. Salam, "An extension of the technology acceptance model in an ERP implementation environment," *Information & Management*, vol. 41, pp. 731–745, 2004.

[32] D. H. Lee, S. M. Lee, D. L. Olson, and S. H. Chung, "The effect of organizational support on ERP implementation," *Industrial Management & Data Systems,* vol. 110, no. 2, pp. 269–283, 2010.

[33] V. Venkatesh, M. G. Morris, F. D. Davis, and G. B. Davis, "User acceptance of information technology: Toward a unified view," *MIS Quarterly*, vol. 27, no. 3, pp. 425–479, 2003.

[34] V. Venkatesh and H. Bala, "Technology acceptance model 3 and a research agenda on interventions," *Decision sciences*, vol. 39, no. 2, pp. 273–315, 2008.

[35] F. Calisir, C. A. Gumussoy, and A. Bayram, "Predicting the behavioural intention to use enterprise resource planning systems—An exploratory extension of the technology acceptance model," *Management Research News*, vol. 32, no. 7, pp. 597–613, 2009.

[36] Y. Sun, A. Bhattacherjee, and Q. Ma, "Extending technology usage to work settings: The role of perceived work compatibility in ERP implementation," *Information & Management*, vol. 46, no. 6, pp. 351–356, 2009.

[37] E. Youngberg, D. Olsen, and K. Hauser, "Determinants of professionally autonomous end user acceptance in an enterprise resource planning system environment," *International Journal of Information Management*, vol. 29, no. 2, pp. 138–144, 2009.

[38] M. Mayeh, T. Ramayah, and A. Mishra, "The role of absorptive capacity, communication and trust in ERP adoption," *The Journal of Systems and Software*, vol. 119, pp. 58–69, 2016.

[39] Y. M. Yi, K. D. Fiedler, and J. S. Park, "Understanding the role of individual innovativeness in the acceptance of IT-based innovativeness: comparative analyses of models and measures," *Decision Sciences*, vol. 37, no. 3, pp. 393–426, 2006.

[40] R. Thompson, D. Compeau, and C. Higgins, "Intentions to use information technologies: an integrative model," *Journal of organizational and end user computing,* vol. 18, no. 3, pp. 25–46, 2006.

[41] P.-F. Hsu, H. R. Yen, and J.-C. Chung, "Assessing ERP post-implementation success at the individual level: Revisiting the role of service quality," *Information & Management*, vol. 52, no. 8, pp. 925–942, 2015.

[42] B. Kositanuri, O. Nqwenyama, and K. M. Osei-Bryson, "An exploration of factors that impact individual performance in an ERP environment: an

analysis using multiple analytical techniques," *European journal of information systems,* vol. 15, pp. 556–568, 2006.

[43] H. Kelley, *Attributional analysis of computer self-efficacy: dissertation*. London, UK: Richard Ivey School of Business, 2001.

[44] S. Bueno and J. L. Salmeron, "TAM-based success modelling in ERP," *Interacting with computers*, vol. 20, no. 6, pp. 515–523, 2008.

[45] C. M., Ringle, S. Wende, and J.-M. Becker, SmartPLS 3, 2015. Boenningstedt: SmartPLS GmbH. [Online]. Available: http://www.smartpls.com. [Accessed Feb. 8, 2016].

[46] M. Tenenhaus, V. E. Vinzi, Y. M. Chatelin, and C. Lauro, "PLS Path Modelling," *Computational Statistics & Data Analysis*, vol. 48, pp. 159-205, 2005.

[47] J. Henseler, G. Hubona, and P. A. Ray, "Using PLS Path Modelling in New Technology Research: Updated Guidelines," *Industrial Management & Data Systems*, vol. 116, no. 1, pp. 2-20, 2016.

[48] G. D. Garson, *Partial Least Squares: Regression & Structural Equation Models*. Asheboro, USA: Garson and Statistical Associates Publishing, 2016.

[49] H. O. A. Wold, "Soft modelling: the basic design and some extensions," in *Systems Under Indirect Observation,* K. G. Joreskog and H. O. A. Wold, Eds. North-Holland, Amsterdam, 1982, pp. 1-54.

[50] C. Fornell and D. F. Larcker, "Evaluating Structural Equation Models with Unobservable Variables and Measurements Errors," *Journal of Marketing Research*, vol. 18, no. 1, pp. 39-50, 1981.

[51] J. Henseler, C. M. Ringle, and M. Sarstedt, "A new criterion for assessing discriminant validity in variance-based structural equation modelling," *Journal of the Academy of Marketing Science*, vol. 43, no. 1, pp. 115-135, 2015.

[52] W. W. Chin, "Issues and opinion on structural equation modelling," *MIS Quarterly*, vol. 22, no. 1, pp. 7–16, 1998.

[53] J. Cohen, *Statistical power analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Lawerence Erlbaum Associates, 1988.

[54] C. M. Ringle and M. Smarted, "Gain more insight from your PLS-SEM results: The importance-performance map analysis," *Industrial Management & Data Systems*, vol. 116, no. 9, pp. 1865-1886, 2016.

[55] S. J. Simon and D. Paper, "User acceptance of voice recognition technology: an empirical extension of the technology acceptance model," *Journal of organizational and end user computing*, vol. 19, no. 1, pp. 24–50, 2007.

[56] G. G. M. Pijpers and K. Montfort, "An investigation of factors that influence senior executives to accept innovations in information technology," *International journal of management*, vol. 23, no. 1, pp. 11–23, 2006.