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Student ERP solution acceptance

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Abstract: *ERP acceptance by its users in companies has been researched by several authors while ERP acceptance by students within study programmes has not been researched so often. It is important for teachers to know which factors have influence on student ERP acceptance, so that they can develop curriculum accordingly. Our study researches student acceptance of ERP solutions while they are exposed to ERP solution and involved in ERP actual use. Our research is based on TAM research model, extended additional external factors such as: experience with computer, computer self-efficiency, personal innovativeness toward IT, computer anxiety, user manuals (help), system quality, social influence (environment), training and education etc. Research was conduct within a group of 121 students after short interaction with Microsoft Dynamics NAV ERP solution. Results show that the most important external factors for student ERP acceptance are: individual benefits, training and education on ERP system and quality of ERP system.*
Keywords: ERP solutions, students, ERP acceptance, TAM

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I. Introduction

The most used integrated software solutions in companies from almost all industries worldwide are Enterprise Resource Planning (ERP) solutions. The number of ERP users is growing very fast and majority of employees are using ERP solutions daily at their work. As a result, there is a substantial demand for students with knowledge of ERP solutions on the labour market

While the number of ERP solution users is growing, a lot of research studies regarding ERP user adoptions/acceptance are emerging (for example see Costa et al., 2016). Of all available research models in this area, TAM is one of the most suitable and widely used model to study adoption in IS (Shih and Huang, 2009; Sternad et al., 2011; Costa et al., 2016) and therefore numerous IS researchers apply this method to ERP research. The key purpose of TAM is to provide a basis for tracing impact of external factors on internal beliefs (perceived usefulness - PU and perceived ease of use – PEOU), attitudes (AT), intentions (behavioural intention - BI) and actual use (Davis et al., 1989).

Despite ERP acceptance by its users in companies has been researched by several authors, ERP acceptance by students within study programmes has not been researched so often. Our goal is to research external factors which influence student acceptance of ERP solutions. Our research model is based on TAM and includes factors of original TAM, but we modified TAM with additional external factors. We have included external factors which we think that will have impact on ERP acceptance: experience with computer, computer self-efficiency, personal innovativeness toward IT, computer anxiety, user manuals (help), system quality, social influence (environment), training and education etc. The survey was conducted on a group of students, who do not have prior knowledge regarding ERP solutions. After description of ERP solutions and literature review, research model is described in details and results of study are presented and discussed.

II. ERP solutions

ERP solutions are usually referred to as a category of business-management software. Typically, this is a suite of 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. The applications that make up the system share data across various

departments (manufacturing, purchasing, sales, accounting, etc.) that provide the data (Almajali, Masa'deh & Tarhini, 2016). 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 (Monk & Wagner, 2009).

The organization Gartner Group first used the acronym ERP in the 1990s (Wylie, 1990). ERP systems experienced rapid growth in the 1990s, because of the year 2000 problem and the introduction of the euro that disrupted legacy systems, so many companies took the opportunity to replace their old systems with ERP (Monk & Wagner, 2009). The ERP II was introduced in 2000 by Gartner Group (Bond et al., 2000) and describes web–based software that provides real–time access to ERP systems to employees and partners (such as suppliers and customers). Their role expands traditional ERP resource optimization and transaction processing and leverages information in the resources under its management to help the organizations collaborate with other organizations. Gartner Group (Ganly et al., 2013) introduced the term "postmodern ERP" (some call it also eXtended ERP – xERP) in 2013. According to Gartner's definition of the postmodern ERP strategy, legacy, monolithic and highly customized ERP suites, in which all parts are heavily dependable on each other, should sooner or later 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.

Early ERP providers focused on large enterprises. In the last few years we notice increasing use of ERP systems also by smaller enterprises. The worldwide ERP market grew 3.8% from 24.4B USD in 2012 to 25.4B USD in 2013. SAP is in market leadership position, follow by Oracle, Sage, Infor and Microsoft (Pang et al., 2013). Predictions show that the worldwide market will grow to 41.69B by 2020, with cloud based deployment models significantly boosting the market growth in the last few year and beyond (Chaudhari & Ghone, 2015).

III. Literature review

Technology Acceptance Model

Several theoretical models 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; Fishbein and Ajzen, 1975), the theory of planned behaviour (TPB; Ajzen, 1991), the theory of the technology acceptance model (TAM; Davis et al., 1989), innovation diffusion theory (IDT; Rogers, 2003), stage model (SM; Poon & Swatman, 1999), technology-environment-organization (T-O-E; Tornatzky & Fleisher, 1990); and resource-based view (Caldeira & Ward, 2003). Compared to competing models, TAM is believed to be more parsimonious, predicative, and robust (Venkatesh and Davis, 2000; Lu et al., 2003; Liu and Ma, 2006), and is most widely used by IS/IT researchers among the theoretical models (Davis, 1989; Davis et al., 1989; Amoako-Gyampah and Salam, 2004; Lee et al., 2010; Costa et al., 2016). TAM posits that two beliefs − perceived usefulness (PU) and perceived ease of use (PEOU) − are of primary relevance for computer acceptance behaviour (Davis et al., 1989). PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320). PEOU in contrast, refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, 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 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., (1989, p. 987) 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 tracing the impact of external factors on internal beliefs, attitudes, and intentions (Davis et al., 1989). The original TAM is well established and tested and furthermore, a variety of extensions regarding external factors by examining the antecedents of PU and PEOU have been developed, such as TAM 2 (Venkatesh and Davis, 2000), UTAUT (Venkatesh et al., 2003) and TAM 3 (Venkatesh and Bala, 2008).

ERP solutions

Even though TAM can be applied to a variety of technologies, the constructs of TAM need to be extended by customizing factors for specific information systems (Calisir et al., 2009). Few studies have investigated ERP user acceptance and usage utilizing TAM, and most of them investigate a small number of external factors (for latest researches see Calisir et al., 2009; Shih & Huang, 2009; Sun et al., 2009; Youngberg et al., 2009; Lee et al., 2010; Sternad et al. 2011; Sternad & Bobek, 2013, 2014; Mayeh et al., 2016; Costa et al., 2016).

See table 1.

Author(s)	Focus
Amoako-Gyampah & Salam, 2004.	They tested the impact of four cognitive constructors (PU, PEOU, perceived compatibility, and perceived fit) on AT and symbolic adoption.

Nah et al., 2004.	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 organisation.
Shivers-Blackwell & Charles, 2006.	They researched student readiness for change (through gender, computer self-efficacy, and perceived benefits of ERP) on BI regarding ERP implementation.
Bradley & Lee, 2007.	They investigated via case studies the relationship between training satisfaction and the PEOU, PU, effectiveness, and efficiency in implementing an ERP solution at a mid-sized university.
Hsieh & Wang, 2007.	They researched the impact of PU and PEOU on extended use.
Bueno & Salmeron, 2008.	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.
Kwahk & Lee, 2008.	They examined the formation of readiness for change (enhanced by two factors: organisational commitment and perceived personal competence) and its effect on the perceived technological value of an ERP solution leading to its use.
Uzoka et al., 2008.	They extended TAM to research the selection of ERP by organisations using factors: impact of system quality, information quality, service quality, and support quality as key determinants of cognitive response as well as which ERP solution to purchase/use.
Calisir et al., 2009.	They examined factors (subjective norms, compatibility, gender, experience, and education level) that affect users' BI to use an ERP solution based on potential ERP users at one manufacturing organisation.
Scott & Walczak, 2009.	They investigated students 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
Shih & Huang, 2009.	Their study attempted to explain BI and AU through incorporated additional behavioural constructs: top management support, computer self-efficacy, and computer anxiety.
Sun et al., 2009.	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.
Youngberg et al., 2009.	They researched impact of PEOU, result demonstrability, and subjective norm on PU and impact of it on usage behaviour.
Lee et al., 2010.	They examined factor organisational support (formal and informal) on original TAM factors.
Sternad et al., 2011.	They expose and research external factors which have influence on ERP users in operation phase and investigate the impact of those factors on ERP solution use in company.
Sternad Zabukovšek& Bobek, 2013.	They extended original TAM with groups of external factors (personal characteristics and information literacy, system and technology characteristics, and organizational-process characteristics) and work compatibility and researched influence the ERP adoption among 44 companies in maturity phase.
Sternad Zabukovšek & Bobek, 2014.	They researched and compareed the importance of external factors for two global solutions - SAP and Microsoft Dynamics NAV – regarding user acceptance.
Costa et al., 2016.	They extended original TAM with factors top management support, training, and the system quality and research their impact on adoption and user satisfaction.
Mayeh et al., 2016,	They examined the effects of factors absorptive capacity (for understanding, for assimilating and for applying), communication and trust (system and vendor) through original TAM and intention to use ERP solution.

Table 1: ERP Literature on TAM. Source: Updated from Sternad et al. (2011).

Just two from above table (Shivers-Blackwell and Charles, 2006; Scott and Walczak, 2009) researched student ERP acceptance through TAM model, but both authors used small numbers of external factors. Shivers-Blackwell and Charles (2006) also researched student readiness to use ERP technology through model TAM, but they researched ERP acceptance after students read an online newsletter titled "What is ERP", so they did not have practical experience with use of ERP solution. Participants were then solicited by their professors to complete the survey. Their research shows that gender and perceived ERP benefits are related to students' readiness for change, and readiness for change is a significant predictor of students' attitude toward usage of the ERP system. Scott and Walczak (2009) 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. The sample consisted of 239 students taking an elective ERP course in the information systems undergraduate and graduate programs.

IV. Student ERP acceptance

To examine ERP users' use of ERP systems, we need to extend the TAM. Synthesizing prior researches on TAM and researches on ERP systems, a conceptual model that represents the cumulative body of knowledge accumulated over the years from TAM and ERP research has been developed (Figure 1).

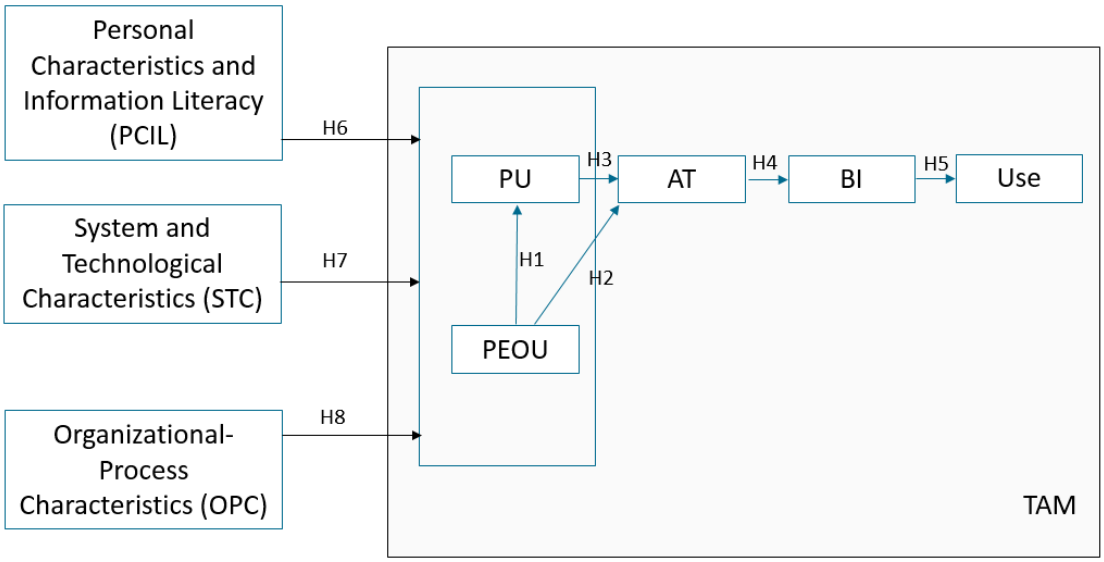

Figure 1: *Conceptual Model*

Our goal is to research student acceptance of ERP solutions while they are involved in ERP topics after short interaction with the systems (after 12 hours) and which external factors have impact on it. We have prepared conceptual model which includes factors of original TAM (perceived ease of use – PEOU, perceived usefulness – PU, attitude toward using ERP system – AT, behaviour intention – BI, actual use - Use). Therefore, we use hypotheses from original TAM (Davis, 1989; Davis et al., 1989):

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, the constructs of TAM need to be extended by customizing factors for specific information systems. One problem with TAM research is that most researchers investigate small number of external factors. In case of ERP acceptance, several external factors may influence user acceptance. Thus, the conceptualisation of multiple, higher-order factors (in our case second-order factors) must be investigated to understand user behaviour.

We exposed in prior researches that external factors could be distributed among three groups of factors which are personal characteristics and information literacy (PCIL), system and technological characteristics (STC), and organizational-process characteristics (OPC) (see Sternad et al., 2011, Sternad and Bobek, 2013; Sternad and Bobek, 2014). In these three groups, we are trying to capture many external factors which influence ERP user acceptance in operational phase. Since we research student acceptance of ERP solution we must adjust and add some other external factors. Personal characteristics and information literacy (PCIL) includes personality characteristics that can influence individuals' perceptions of ERP system acceptance and usage. In addition to those we expose several external factors in group PCIL which are: personal innovativeness toward IT (Yi et al., 2006; Thompson et al., 2006), computer anxiety (Venkatesh, 1998; Venkatesh et al., 2003), computer self-efficiency (Venkatesh and Davis, 2000; Venkatesh et al., 2003; Shih and Huang, 2009) and individual benefits (Hsu et al., 2015). 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. Surveying different previous research, the following external factors have been exposed in group of STC: system performance (Venkatesh et al., 2003; Kositanurit et al., 2006), user manuals (help) (Kelley, 2001; Kositanurit et al., 2006), quality of ERP system (Costa et al., 2016) and quality of information in ERP system (Hsu et al., 2015). Organizational-process characteristics (OPC) capture various social processes, mechanisms, and support organizations that guide individuals to facilitate the use of an ERP system. OPC includes social influence (Venkatesh, 1998; Venkatesh et al., 2003) and training and education on ERP system (Amonko-Gyampah and Salam, 2004; Bueno and Salmeron, 2008; Bobek and Sternad, 2011). Therefore, it is hypothesized:

H6: A group of external factors influence use of the ERP system through the conceptual factor personal characteristics and information literacy (PCIL).

H7: A group of external factors influence use of the ERP system through the conceptual factor system and technological characteristics (STC).
H8: A group of external factors influence use of the ERP system through the conceptual factor organizational-process characteristics (OPC).

V. Research design and procedure

The components of the proposed model are PU, PEOU, AT, BI and U, where PU and PEOU are influenced by various external factors. The external factors are distributed among three second-order constructs which are: personal characteristics and information literacy (PCIL), system and technological characteristics (STC), and organizational process characteristics (OPC). Second-order factors are composed by specifying a latent variable which represents all the manifest variables of the underlying lower-order factors. PCIL includes: personal innovativeness toward IT, computer anxiety, computer self-efficiency and individual benefits. STC is composed of: system performance, user manuals (help), quality of ERP system and quality of information in ERP system. OPC includes: social influence and training and education on ERP system. Our conceptual model includes 15 first-order factors and 3 second-order factors.

We already did researches regarding user acceptance of ERP solutions (different phases, various ERP solutions, countries etc.) in organizations. 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. 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 student's ERP usage. Demographic information was collected as well.

The survey was conducted in a group of 121 students, who have course E-business (all students of professional programme in the 3rd year). They do not have any knowledge regarding ERP solutions at the beginning of the course. Course includes 15 teaching hours of lectures from ERP topics with focus on the business processes in Microsoft Dynamics NAV and 15 teaching hours of exercises in computer lab where they have hands on training of some business processes in Microsoft Dynamics NAV (introduction, purchasing process, manufacturing process and sales process). We are using version Microsoft Dynamics NAV 2016 (NAV).

The survey was carried out after short interaction with NAV solution (after 1st month; 12 hours). Students had 8 hours of lectures (topics covered ERP solutions, Microsoft Dynamics solutions and Microsoft Dynamics NAV, purchasing process in NAV and production process in NAV) and 4 hours of computer lab exercises (hands-on training of navigation and purchasing process). Students received paper version of questionnaire in the beginning of lecture class and had half an hour to solve it. 121 questionnaires were properly filled out by respondents and analysed.
Respondents were 38.8% (47) male and 61.2% (74) female, with average age of 21.66 years.

VI. Analysis and results

Demographic data were analysed by SPSS. All other empirical data were analysed in two stages with PLS technique, using Smart PLS 3.2.1. Partial least squares (PLS) approach can be employed to estimate the parameters of a hierarchical model and also allows the conceptualisation of higher-order factors through the repeated use of manifest variables (Tenenhaus et al., 2005). 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. We employed the PLS approach because of the relatively small number of samples of valid data and our desire to analyse second-order factors (Ringle et al., 2015).

All measurement scales were examined for their psychometric properties (reliability, convergent validity, and discriminant validity) prior to testing hypotheses (bootstrapping with 500 subsamples). Results of measurement model were satisfactory (results can be obtained from authors). The hypothesis testing results utilize bootstrapping (with 500 subsamples) to test the statistical significance of each path coefficient using *t*-tests, as recommended by Chin (1998). Results of this analysis are shown in Figure 2.

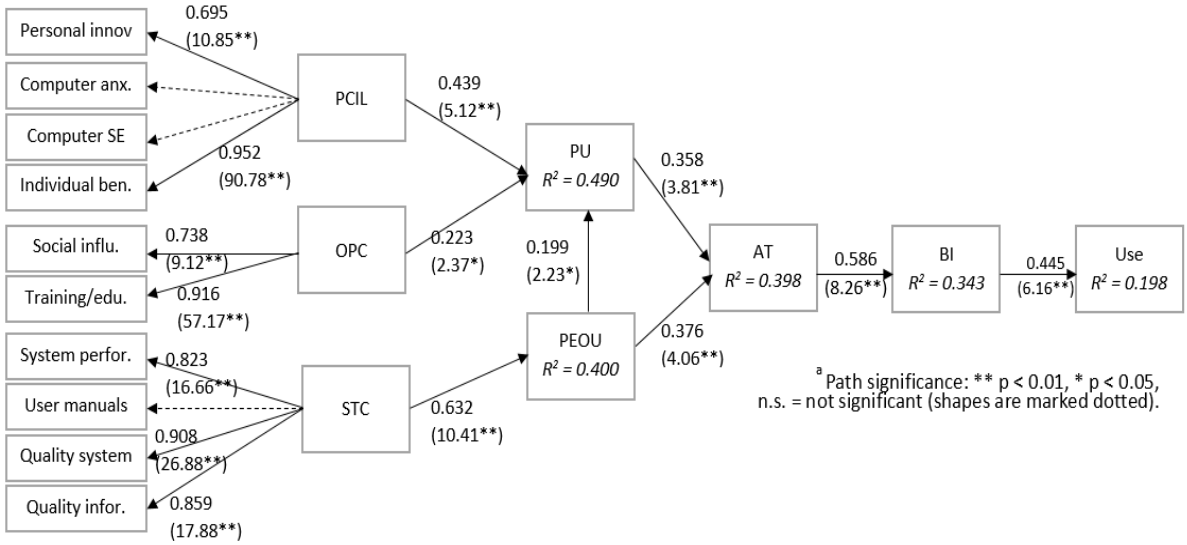

Figure 2: Results of structural model analysis

Our research confirms results of original TAM. Perceived ERP ease of use (PEOU) has weak but significant effect on perceived ERP usefulness (PU) (H1; b = 0.199, p<0.05) and strong significant effect on attitude toward using ERP system (AT) (H2; b = 0.376; p<0.01). Perceived ERP usefulness (PU) has strong significant effect on attitude toward using ERP system (AT) (H3; b = 0.358; p<0.01). Attitude toward using ERP system (AT) strongly influences on behaviour intention (BI) (H4; b = 0.586; p<0.01) and behaviour intention (BI) strongly influences on actual use (Use) (H5; b = 0.445; p<0.01). Second-order factors (PCIL, OPC and STC) have significant positive effect on perceived usefulness (PU) and on perceived ease of use (PEOU). PCIL has a strong positive effect on perceived ERP usefulness (PU) (b = 0.439, p<0.01). OPC has a weak but significant effect on perceived ERP usefulness (PU) (b = 0.223, p<0.05). STC has very strong positive effect on perceived ERP ease of use (PEOU) (b = 0.632, p<0.01), and these findings provide empirical support for hypotheses H6, H7, and H8.

VII. Discussion

Our results of original TAM model go with results of other researchers who research IT/IS acceptance (Davis, 1989; Davis et al,. 1989; Heijden, 2001; etc.). Both perceived ERP usefulness (PU) and perceived ERP ease of use (PEOU) have strong positive effect on ERP usage, where relationship of perceived ERP ease of use (PEOU) is a little stronger. This is not consistent with Davis (1989), Davis et al. (1989) and Simon and Paper (2007) who expose that perceived usefulness (PU) has stronger positive effect on IT/IS usage as perceived ease of use (PEOU), while perceived ease of use (PEOU) has not so strong or even not statistical effect on IT/IS usage after some time of usage. On the other hand, results of some researches show stronger effect of perceived ease of use (PEOU) on attitude toward using ERP system (AT) than perceived ERP usefulness (PU) on attitude toward using ERP system (AT) (for example see Nah et al., 2004). The reason for this could be, because the survey was carried out only after short period of ERP solution learning. Some IT/IS researches show strong positive effect of perceived ERP ease of use (PEOU) on perceived ERP usefulness (PU) (Heijden, 2001; Davis, 1989), but this is not consistent with our study, where perceived ERP ease of use (PEOU) has weak positive effect on perceived ERP usefulness (PU). Empirical findings on that relationship in the context of ERP are different, since some researches did not confirm a statistically significant relationship between the two (Hwang, 2005; Shivers-Blackwell and Charles, 2006; Shih and Huang, 2009), while other researches confirmed a statistically significant positive relationship (Amonko-Gyampah and Salam, 2004; Hsieh and Wang, 2007; Bueno and Salmeron, 2008; Calisir et al., 2009; Lee et al., 2010). Factor attitude toward using ERP system (AT) is vital in the TAM model and has very strong positive effect on behavioural intention (BI) and through it also indirect strong positive effect on actual use (Use), which is consistent with other researches (Pijpers and Montfort, 2006; Simon and Paper, 2007; Nah et al., 2004).

The aim of this research was to identify external factors which influence student ERP usage after their short interaction with NAV solution. Based on the analytical results, we can see that it is possible to observe more external factors through second-order factors. The fact that ERP implementation research is focused on one solution (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 (STC)

upon the ERP system's user acceptance (except ours, see Sternad et al., 2011; Sternad Zabukovšek and Bobek, 2013, 2014). STC has strong impact on perceived ease of use (PEOU) through external factors system performance, quality of NAV system and quality of information in NAV system. Factor user manuals is not statistically significant – it could be because students did not work alone (individual work) and they did not use user manuals until then.

Second order factor Personal characteristics and information literacy (PCIL) through personal innovativeness toward IT (software tools and applications) and individual benefits has greater impact on perceived usefulness (PU) than second order factor Organizational-process characteristics (OPC) through social influence and training and education on ERP system. This means that for students it is more important to see individual benefits using ERP systems and that they like to use any computer tool/applications than social influence and training and education on ERP system.

Furthermore, individual benefits (enhanced awareness and recall of future job, enhanced effectiveness in the job, increases productivity, positive effect on my future career etc.) has stronger effect on perceived usefulness (PU) than personal innovativeness toward using software tools and applications (I like to experiment with new IT, I'm usually the first to try out new IT, I like to experiment with new IT). Factors computer anxiety and computer self-efficiency are not statistically significant – these students are students of higher class (3rd year professional programme), who already had several courses related to IT during the primary and secondary schools and previous years at faculty. Factor training and education of NAV (lectures provide overview on business processes in NAV, materials of lectures/lab exercises are appropriate, based on lectures I understand why I have to be able to use NAV) has stronger effect on perceived usefulness (PU) than social influence (people (teachers, students, professionals) who have influence on students' perception regarding NAV/ERP).

VIII. Conclusion

The aim of this research was to research which external factors have impact on students' acceptance of ERP within the study programme, while they are exposed to ERP solution (in our case Microsoft Dynamics NAV). With the knowledge of importance of external factors, we could better motivate students to take the course E-business more seriously. We exposed 10 external factors which have impact on student ERP acceptance. This work extended previous researches by incorporating groups of external factors, which have influence on students ERP acceptance. Studying the influence of more external factors on constructs not only contributes to the theory development, but also helps in designing teacher curriculums.

Our research shows that external factors personal innovativeness toward IT (software tools and applications) and individual benefits (regarding future job) are very important personal factors which have impact on students ERP usage, while computer anxiety and computer self-efficiency are not important. It could be because students did not work alone (individual work) and they did not use user manuals until then. Organisational-process factor training and education of ERP is more important than factor social influence (people (teachers, students, professionals) who have influence on students' perception regarding NAV/ERP) and therefore we suggest that teachers put more effort in preparing excellent teaching materials and invest more in explaining ERP related content appropriately. Scott and Walczak (2009) results show the importance of intrinsic and extrinsic motivation of ERP training, through cognitive engagement (a form of intrinsic motivation) and organizational support (a form of extrinsic motivation). Understanding of ERP solutions is challenging for students, because they do not have practical experience of how ERP solutions are used in enterprises. Important system-technological factors are system performance, quality of NAV/ERP system and quality of information in NAV/ERP system, while factor user manuals is not important after short interaction with the system.

The implications for researchers and practitioners include an extended version of TAM through second-order factors to improve the explanatory power of ERP usage. The technique (PLS approach) for analysis of model was used. This study has certain limitations which may present the opportunity for further research. Since the respondents were limited to one group of students in Slovenia, this study should be extended to other counties. Further research is needed to explore the importance of presented external factors in different time frames (after introduction of the course, at the end of the course), as well as including additional external factors. Another limitation is also that research was conducted for one ERP solution –Microsoft Dynamics NAV, because of that the importance of external factors of different ERP solutions also could be explored (SAP, Infor ERP etc.).

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