Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 9 (2013) 84 – 93

Procedia Technology

CENTERIS 2013 - Conference on ENTERprise Information Systems / ProjMAN 2013 - International Conference on Project MANagement / HCIST 2013 - International Conference on Health and Social Care Information Systems and Technologies

Commercial ERP systems and user productivity: A study across European SMEs

Pedro Ruivo[a]*, Björn Johansson[b], Tiago Oliveira[a], Miguel Neto[a]

[a]*ISEGI, Universidade Nova de Lisboa, Campus de Campolide, 1070-312 Lisbon, Portugal,*
[b]*Department of Informatics, School of Economics and Management, Lund University, SE-223 63 Lund, Sweden*

Abstract

Enterprise Resource Planning (ERP) systems and productivity aspects are currently experiencing an increasing interest from both the academic and business communities. In this study we aim to measure how firms perceived the impact of their ERP systems on user productivity. Theoretical grounded on a research framework, 2000 web-survey was sent out to European Small and Medium-sized Enterprises (SMEs) from Denmark, Portugal, Spain and Sweden to accesses user productivity amongst the four top commercial-packaged ERP (Microsoft, SAP, ORACLE and SAGE).
We measured six user productivity factors: system Compatibility, system Complexity, transactional Efficiency, embedded Best-practices, online Training and employee Empowerment. This research found that overall executives on average rated user experience with Microsoft Dynamics NAV more favorably. Furthermore, while system compatibility, online training and embedded best-practices achieve higher scores amongst Dynamics NAV, employee empowerment scores higher for SAP All-in-One and transactional efficiency attain high score for ORACLE JDE. Moreover SAGE X3 was scored as having the highest system complexity. This study is far more important for the questions it raises about how firms should be assessing the commercial-packaged ERP contribution makes to their business performance through users rather study the ERP users.

Keywords: ERP; commercial-packaged; user productivity; SMEs

*Corresponding author. Pedro Ruivo Tel. +351210491063
E-mail address: pruivo@isegi.unl.pt

doi:10.1016/j.protcy.2013.12.009

1. Introduction

According to Gartner [1] study, worldwide enterprise software revenue is on pace to surpass $267 billion in 2012, a 9.5 percent increase from 2011 revenue of $244 billion. The enterprise software market is projected for continued growth in 2013, with revenue forecast to reach $288 billion, and enterprise resource planning (ERP) is the largest segment within the enterprise software market. Furthermore the IDC [2] report state that SAP, ORACLE, SAGE, and MICROSOFT are the world's top four ERP vendors regarding licenses, maintenance, and subscription revenue. Many firms run their daily business with one of these ERPs, which amongst them account for nearly half of the market share. A study from AMR Research [3] finds that only a limited set of employees have a deep impact on productivity at firms, only 15% of employees are licensed to use their company's ERP system and furthermore that 46% of licensed ERP seats go unused. Moreover, Iansiti [4] study found that ERP effectiveness use depends not on how much a firm invests but how effectively managers make use of their ERP investment; in particular on user attitudes are of prime importance to raise productivity.

It is known that SMEs are fundamentally different compared to large enterprises and ERP systems play a critical role depending on the organizational size [5-8]. Taking into account that European landscape (including Denmark, Portugal, Spain, and Sweden) is majority composed by SMEs (99%) [9], important for increasing productivity and gaining competitive advantage in the global economy, it can be stated that organizational applications and managerial implications of ERP systems play an important role in providing deep understanding of the phenomenon to researchers and practitioners in the IS domain.

Gartner [1] predicts that the pace of growth in Europe is slowing, mostly because of recent currency appreciation, fiscal tightening, higher commodity prices and concerns about countries debt. It is therefore urgent that these additional constraints on growth and acquisition of IT resources makes more imperative the study of ERP and user's productivity in order to decision making process of firms business applications adoption to raise productivity and support competitiveness strategies.

Motivated by these issues, in this study we will evaluate the extent to which users of ERP systems in the post-adoption stages perceived that the commercial package makes them productive in ways relevant to them in their day-to-day responsibilities. To attain this, we assessed a conceptual model and empirically check it using 883 surveys from the large scale survey submitted to 2000 SMEs in four European countries. The theoretical background and the research model proposed are outlined in the next two sections. Then in third section we present the research methodology and data. The penultimate section then presents and discusses results and findings from collected data. Finally, we offer conclusions, implications, limitations and suggest some topics for future work in the area of ERP productivity.

2. Theoretical background

The majority of existing ERP studies focuses on large enterprises, adoption versus non-adoption and on implementations success factors, this study focus on post-adoption stage, that is, the impact of ERP usage on user productivity.

2.1. ERP system and user's productivity

Numerous firms have successfully adopted ERP systems for a variety of reasons. ERP is considered as one of the most important innovations that will allow companies to achieve substantial benefits by automatizing, standardizing and monitoring business performance [7]. In a research conducted by Hitt et al [10] it was found that firms that adopted ERP systems exhibit better performance in both terms of user productivity and firm's

performance; sales per employee, profit margins, return on assets, inventory turnover, asset utilization, payable and receivables accounts turnover, etc. This study also measured firms that adopted ERP are 4.2% higher in productivity, they suggests a correlation between ERP user productivity and firms performance, due to the fact that adopters of ERP are also likely to be more extensive users of information technology. On other hand, some ERP implementations fail to attain a strong business benefits from the system, in particular to ERP usage and its impact on firm's performance. One important reason for its failure is related with the reluctance or unwillingness of users to accept ERP system. Therefore, a good understanding of users acceptance of ERP systems is essential to user productivity [11]. On business applications such as ERP system, the goal of management is to achieve a relevant level of use of the system. Firms are recognizing that individual user productivity with information systems is one of the most important determinants for firm's organizational productivity [12]. A study conducted by Kositanurit et al. [13] concludes that ERP usage is a major factor affecting work at the individual level and user performance is a direct result of system usage. Studies from Amaoko-Gyampah [12] and Nah et al. [14] found that users are more concerned with whether the ERP system can help them perform their daily job functions rather than with system capabilities to integrate data. Accordingly with Zhu and Kraemer [15], one of today's most important business characteristic is the Internet and applications that it connects; described by open standard, public network and broad connectivity of IT. Since these technologic characteristics are broadly accessible, will have different impacts on user productivity and consequently on overall firm's productivity. ERP systems are designed to meet these characteristics by embedding technological and functional competences that can only be streamlined by firm's user usage.

2.2. ERP users and SMEs

Despite the reported problems, it is unquestionable that, when properly implemented, ERP systems can and do provide a number of tangible and intangible operational and strategic benefits for both enterprise and SMEs [7, 10, 16]. Most of the literature about ERP systems benefits has been focus on large firms and in the form of general organizational impacts, not studying the individual level impact. Studies conducted by Butler et al. [17] and Grandon and Pearson [18] conclude that innovation decision process at individual level is more applicable to SMEs. This is a simple process with a high involvement behavior. But SMEs limited resources somehow exclude them from experimental behavior; many fail in their IT adoption because they adopt the technology with partial or without knowhow how to use it to improve productivity. On this direction, Parker and Castleman [19] criticizes Roger's [20] model and Tornatsky and Fleischer [21] framework for not providing an outlook into the multiple specificities of SMEs involving the relationship of families, business networks, local communities, and industries, each with possibly contradicting norms, behavior, performance and social value systems, all these variables affect user productivity and impact overall firms performance. Parker and Castleman [19] stated that organizational process involves a formal structure but SMEs have less formal structures and less rigid decision frameworks and are ideally expected to exploit the opportunities of IT more than large corporations, leveraging individual and firm's productivity. Furthermore, Srivardhana and Pawlowski [22] in their research conclude that the output and productivity impact of ERP system comes from effective utilization of the technology. Calisir and Calisir [23] examined the influence of ERP usage and concluded that perceived usefulness has an effect on user productivity; this conclusion is in accordance with Herbert [24] study that concluded that "system design can profoundly affect user productivity and consequently ERP failure". Furthermore, a study conducted by Cooprider et al [25] reinforce that costs associated with an inappropriate package, over ERP lifetime, are significantly higher than the cost of the application itself and produces a decrease in productivity due poor user adoption. Combining these factors, we can see that there are significant additional considerations beyond those addressed in the ERP literature. Thus,

we developed the research framework to assess impact of ERP on user productivity in SMEs, which is presented next.

3. Research framework

Next we present the framework and explain the key elements for each factor. This study uses a synthesis of industry standards in combination with Ruivo et al. [7] and Iansiti [4] determinants to measure the factors which impact of ERP on user's productivity. The research framework proposed for this study is presented in Figure 1, and it outlines that Compatibility, Complexity, Efficiency, Best-practices, Training and Empowerment have a direct impact on user productivity. Among the wide range of factors that we found from the literature review on previous studies of ERP, we considerate these factors to be particularly relevant to business applications.

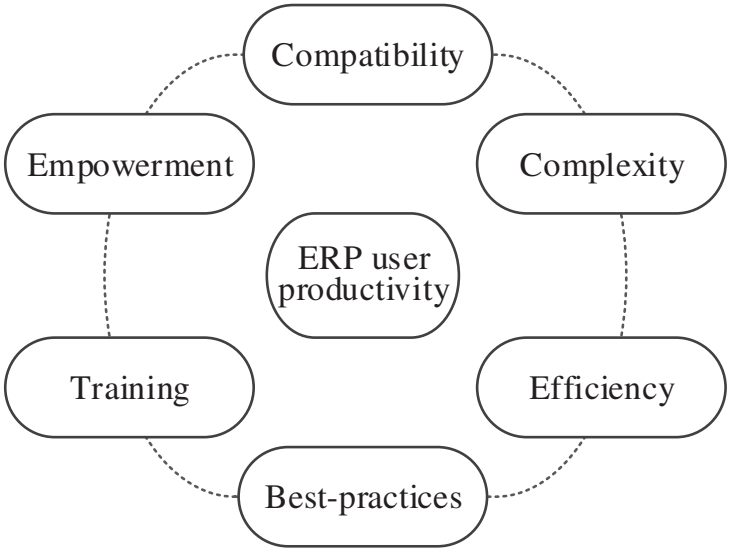

Fig. 1. Research framework to assess the impact of ERP on user productivity

The research framework measure six factors about how users of ERP describe system impact on their business productivity:

System *compatibility* is measured by the degree to which the ERP system matches IT features, such as compatibility with hardware and other software [26-28].

System *complexity* is measured by reversing the item-questions scale of how intuitive the application is; how quickly users can become proficient with application; and how comfortable they are using it [13, 29, 30].

Transactional *efficiency* is measured by how easy it is for users to execute common and repetitive tasks, the effectiveness of the user interface, and the speed and reliability of the software [31-33].

Best-practices is measured by how easy it is for users to set up the application and map workflows based on local requirements, and the system's adaptability to business needs [34-37].

The online *training* factor is a measure of how easy it is for users to be trained on the system, to understand the content material, and to navigate through topics applied to daily tasks [26, 38].

Employee *empowerment* factor is measured by how well the software enables collaboration, role tailored reporting, and access to real-time information [23, 31, 39, 40].

4. Research methodology and data

A survey instrument was designed accordingly with Dillman's [41] methodology to measure how firm's executives assess to the extent users of ERP describe the impact of the system on their productivity. The survey consists of eighteen item questions on software business productivity and grouped into the six factors, and was sent in September and October 2011 (shown in Appendix). In total, 2000 SMEs received the questionaries' and 883 valid responses were returned, resulting in a response rate of 44%, which is compared to others studies of similar scale is much higher. Each factor was measured by three item-questions using a five-point Likert scale, where 1 means "low" and 5 "high", A higher score indicates a higher business productivity impact. The table with individual item-question scores is available from the authors on request. To ensure the generalization of the survey results, the sampling was stratified by country (Denmark, Portugal, Spain, and Sweden), by firm size (between 50 and 250 employees), by ERP vendor's commercial-packaged proposal for SME market (Microsoft NAV, ORACLE JDE, SAGE X3 and SAP All-in-One) and by industry type (finance, distribution, manufacturing, and professional services). Table I show the characteristics of the sample.

Table 1. Characteristics of the sample

Characteristics		(N)	(%)
Industry type	Distribution	252	28.5
	Manufacturing	222	25.1
	Finance	216	24.5
	Professional services	193	21.9
Country	Denmark	107	12.1
	Portugal	134	15.2
	Spain	424	48.0
	Sweden	218	24.7
Commercial package	DYNAMICS (NAV)	266	30.1
	ORACLE (JDE)	208	23.6
	SAGE (X3)	192	21.7
	SAP (All-in-one)	217	24.6

Notes: N - represents the number of responses
% - represents the percentage of the 883 respondents
% - represents the percentage of the 883 respondents

5. Results and findings (abbreviated)

The purpose of this paper was to measure six factors how users of ERP applications describe the impact of Microsoft Dynamics NAV, ORACLE JDE, SAGE X3 and SAP All-in-One applications on their business productivity across the European SMEs. The score for each user productivity factor is the average score across all the three item-questions responses.

5.1. Overall analysis

The overall score is a weighted average, which is derived by averaging the scores of each factor. Overall, Dynamics NAV score a higher user productivity impact (Figure 2).

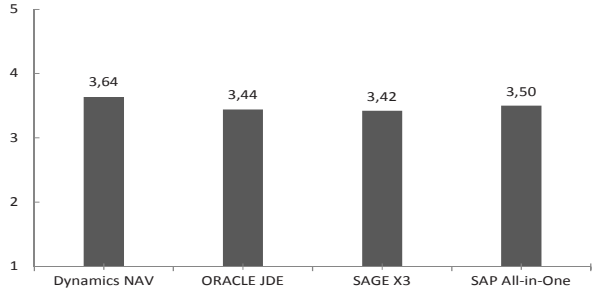

Fig. 2. Overall average score of ERP impact on user productivity

On all six factors measured, Microsoft Dynamics NAV scored higher than others (3.64), followed by SAP all-in-One (3.50), and ORACLE JDE and SAGE X3 (3.44 and 3.42 respectively) as shown in Figure 2).

Across European SMEs, this study has found with a high degree of confidence that as shown by the average scores attain in all four commercial-packaged, ERPs greatly contribute to users' productivity.

5.2. Individual factor analysis

In order to deepen the analysis, we next present the result of each individual factor related to the different ERP packages and how each individual factor was perceived influencing user productivity gained from the usage of the ERP. The factors scores (average) are shown in Table 2, and each factor is then discussed under respectively subheading.

Table 2. ERP packages and each respectively factor score influencing user productivity

ERP package/factor	Dynamics NAV	ORACLE JDE	SAGE X3	SAP All-in-One
Compatibility factor score	4,17	3,57	3,70	3,63
Complexity factor score	3,29	3,36	3,47	3,30
Efficiency factor score	4,01	4,11	3,77	3,96
Best-practices factor score	3,71	3,40	3,44	3,47
Training factor score	3,30	3,17	3,24	3,21
Empowerment factor score	3,95	3,78	3,85	4,03

5.2.1. Compatibility

High system compatibility scores refer to ERP technical compatibility with existing systems (retained systems), including hardware, software and networks. In an ERP environment, it is likely that certain networks will be retained and must be integrated with the ERP system. The easier it is the integration with retained systems, the greater the chances of realizing organizational benefits as well the more compatible the ERP is with remaining hardware and software, the more satisfied users will be.

As shown in Table 2 (Compatibility factor score), Microsoft Dynamics NAV is perceived as having best compatibility. It attained the highest score (4.17) meaning that the ERP is perceived as more compatible with IT infrastructure and therefore leverage user productivity, followed by SAGE X3 and SAP All-in-One (3.70 and 3.63 respectively). The ERP package which was perceived as having weakest compatibility was, ORACLE JDE that was scored 3.57 as average.

5.2.2. Complexity

Complexity is seen as something negative, and as a consequence on that it was measured with a reverse scale. This means that the lower score the better. In practice this means that lowest system complexity scores drive user adoption and reflect users' predisposition to explore, discover and actually utilize ERP and functionalities, meaning significant investments are actually put to work. So, lower complexity impels and encourages users to extract more value from the system through more frequent and broader use.

The result from the survey, (Table 2, Complexity factor score) shows that Microsoft Dynamics NAV attained the lowest score (3.29) meaning that the systems is perceived as less complex and from that it can be suggested that it is the package that have highest support of user productivity in relation to the complexity factor. On the opposite side, SAGE X3 is found as the ERP package with highest complexity score (3.74) followed by ORACLE JDE and SAP All-in-One (3.36 and 3.30 respectively).

5.2.3. Efficiency

Transactional efficiency communally represents the classical approach to ERP systems, with a substantial focus on repetitive, volume-oriented operations. It is also an area emphasized in feature comparison evaluation methods. While transactional efficiency is critical, this study asserts that user productivity is about considerably more than individual performance on isolated tasks.

As shown in Table 2, (Efficiency factor score) ORACLE JDE score high (4.11), meaning that the ERP is perceived as being most efficient, where reliability and effectiveness on the application improves user confidence. The ORACLE ERP is followed by Microsoft Dynamics NAV (4.01) and SAP All-in-One (3.96) and then SAGE X3 which is perceived as having lowest transactional efficiency (3.77).

5.2.4. Best-practices

Best-practices is and have been in focus for many years, in practice it means that organizations adopting an ERP system has to decide on if they should follow the inherited business processes in the system or if they should customize the software. It can be claimed that the longer time an ERP has been developed the more the system have developed its best-practices. However, what is clear is that all vendors claim that their system as a commercial-packaged ERP systems incorporate best-practices. The best-practices mean that the software reflects the vendor's interpretation of the most effective way to perform each business process. Departing from legal requirements to industry-standards, to complete business workflows and daily tasks translates into consolidated and harmonized process as well reporting which improves user productivity. From this we then investigated how decision-makers perceive that the ERP systems incorporated best-practices influences user productivity. The results from this shows that (Table 2, Best-practices factor score) Microsoft Dynamics NAV got the highest score (3.71) followed by SAP All-in-One (3.47) and SAGE X3 (3.44), while ORACLE JDE was perceived as being the system having lowest (3.40) influence on user productivity from best-practices.

5.2.5. Training

Adoption is accelerated through training to make user familiar with the ERP system. While this is a traditional area of focus for successful use of ERP, vendors try to differentiate their applications by how easy users learn the application without extensive formal training (thru online) and quickly attain a high level of proficiency in using the ERP system. Low barriers to learning also contribute to higher adoption rates among users. Training encourages users to explore the software and enable them to find and utilize new functions and capabilities, further enhancing productivity.

From the study it is found that (Table 2, Training factor score), Microsoft Dynamics NAV attained the highest score (3.30) which indicate that this ERP system is perceived as the easiest to be trained on, followed

by SAGE X3 (3.24), SAP All-in-One scored (3.21) and finally ORACLE JDE (3.17), which is perceived as the hardest ERP system to be trained on.

5.2.6. Empowerment

Applications that drive employee empowerment deliver more accurate, relevant, and timely data to users. As users take advantage of data, they extend their usage of the software beyond basic, repetitive tasks to making fact-based decisions. The more applications deliver information in the context of the processes for which a user is responsible, the more likely that users can make accurate decisions faster. Furthermore, as businesses rely on tight communication and collaboration within firm's departments, suppliers, partners, and customers, applications that empower users thru collaboration and thereby is productivity increased.

The result related to this factor, Empowerment factor score (Table 2), shows that SAP All-in-One attained the highest score (4.03) meaning that the systems is perceived as a greater tool to sponsor employee empowerment and therefore supporting user productivity, followed by Microsoft Dynamics NAV with 3.95. SAGE X3 and ORACLE JDE scored 3.85 and 3.78 respectively.

Although these six factors are areas of focus for vendors trying to differentiate their ERP offer, the low level of differentiation found between the four commercial-packaged ERPs suggests that both vendors' systems are well evolved in this respect. This might be the reason why the greater majority of firms run their daily business with one of these ERPs, which amongst them account for nearly half of the market share [2].

6. Conclusions and Implications

The aim of this study was to provide insights into the IT productivity subject, more precisely focus attention on the interplay of Enterprise Resource Planning (ERP) use across European Small and Medium-sized Enterprises (SMEs) and the impact ERP systems can have on user productivity. The research framework provides a useful instrument to measure perceptions at firm level and from that analyze impact of ERP use according to the six productivity factors (Compatibility, Complexity, Efficiency, Best-practices, Training and Empowerment). Referring to the overall average score respondents scored Microsoft Dynamics NAV higher across the six factors, followed by SAP all-in-One, ORACLE JDE and SAGE X3. A major reason for this is the high score Microsoft Dynamics NAV got on compatibility, which could be concluded as coming from the fact that a lot of organizations use other Microsoft's product extensively. Oracle on the other hand got the highest score on efficiency, which could be explained from the fact that Oracle for many years has focused a lot on development of their database solution. Regarding best-practices the study reveals that Microsoft Dynamics NAV got the highest score, which maybe is a surprising finding when, consider that for instance SAP has focused on best-practices for many years. However, when referring to the characteristic to the sample and the focus on SMEs, one has to remember that Microsoft Dynamic NAV has had a focus on SMEs from its inception.

Four implications surface from this study: 1) To the authors knowledge this is the first research studding user productivity amongst commercial-packaged ERPs across European SMEs adding a real-world report to the IS body 2) The importance of user productivity should be considered as one of the most important categories in ERP adoption decisions. 3) Great user productivity is driven by more than an appealing user interface and must be evaluated on the six factors above. 4) ERP systems differ in their ability to be compatible with other IT parts, ease of use (less complex), transactional efficiency, embedded best-practices functionalities, easy of training, employee empowerment, and valuable to users and high scores in these areas positively impact user productivity.

This study has two limitations that point to further research: 1) In accordance with the ground of the present study, user productivity was measured amongst the four top commercial packaged ERPs. Future work

should also assess others systems, in particular country based ERPs. 2) Most likely do also different environments influence user productivity and we encourage further studies that compare industries. The main contribution from this study is the contribution to the debate of ERP and productivity domain, as it encourages both academy and industry as a whole to dedicate itself to furthering user productivity in all its dimensions.

References

[1] Gartner, Forecast: Enterprise Software Markets, Worldwide, 2008-2015. Gartner Group, 2011.
[2] IDC, Worldwide ERP Applications 2009-2013 Forecast and Vendor Shares. 2009.
[3] Research, A., The ERP Market Sizing Report, 2006–2011. AMR Research, 2007.
[4] Iansiti, M., ERP end-user business productivity: A field study of SAP & Microsoft. Keystone strategy, 2006.
[5] Mabert, V.A., A. Soni, and M.A. Venkataramanan, The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector. The International Journal of Management Science, 2003. 31(1): p. 235-246.
[6] Buonanno, G., et al., Factors affecting ERP system adoption: A comparative analysis between SMEs and large companies. Journal of Enterprise Information Management,, 2005. 18(1): p. 384-426.
[7] Ruivo, P., T. Oliveira, and M. Neto, ERP use and value: Portuguese and Spanish SMEs. Industrial Management & Data Systems, 2012. 112(7): p. 1008- 1025.
[8] Brent, S., et al., ERP implementation at SMEs: analysis of five Canadian cases. International Journal of Operations & Production Management, 2009. 29(1): p. 4-29.
[9] Commission, E. (2011) Annual Report on EU Small and Medium sized Enterprises 2010/2011.
[10] Hitt, L.M., D.J. Wu, and X. Zhou, Investment in enterprise resource planning: business impact and productivity measures. Journal of Management Information Systems, 2002. 19(1): p. 71-98.
[11] Sun, Y., A. Bhattacherjee, and Q. Ma, Extending technology usage to work setting: The role of perceived work compatibility in ERP implementation. Journal of Information and Management, 2009. 46: p. 351-356
[12] Amoako-Gyampah, K., ERP Implementation Factors a Comparison of Managerial and End-User Perspectives. Business Process Management Journal, 2004. 10(2): p. 171-181.
[13] Kositanurit, B., O. Ngwenyama, and K. 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, 2006. 15: p. 556-568.
[14] Nah, F., X. Tan, and S.H. The, An Investigation on End-Users Acceptance of Enterprise Systems. Information Resources Management Journal, 2004. 17(3): p. 32-53.
[15] Zhu, K. and K.L. Kraemer, Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry. Information Systems Research, 2005. 16(1): p. 61-84.
[16] Raymond, L. and S. Uwizeyemungu, A profile of ERP adoption in manufacturing SMEs. Journal of Enterprise Information Management, 2007. 20(4): p. 487-502.
[17] Butler, A., M. Reed, and P.L. Grice, Vocational training: Trust, talk, and knowledge transfer in small businesses. Journal of Small Business and Enterprise Development, 2007. 14(2): p. 280-293.
[18] Grandon, E. and J. Pearson, Electronic commerce adoption: An empirical study of small and medium US business. Information and Management, 2004. 42(1): p. 43-52.
[19] Parker, C. and T. Castleman, Small firm e-business adoption: A critical analysis of theory", Journal of Enterprise Information Management, 22. Journal of Enterprise Information Management, 2009. 22(1): p. 167-182.
[20] Rogers, E.M., Diffusion of innovations. 4th ed. 1995, New York: The Free Press.
[21] Tornatsky, L. and M. Fleischer, The Process of Technology Innovation. Lexington Books ed. 1990, Lexington, MA.
[22] Srivardhana, T. and S. D.Pawlowski, ERP systems as an enabler of sustained business process innovation: A knowledge-based view. The Journal of Strategic Information Systems 2007. 16(1): p. 51-69.
[23] Calisir, F. and F. Calisir, The Relation of Interface Usability Characteristics, Perceived Usefulness, and Perceived Ease of Use to End-User Satisfaction with Enterprise Resource Planning (ERP) Systems. Computers in Human Behavior, 2004. 20(4): p. 505-515.
[24] Herbert, L., Put business applications to the usability test. Forrester Research, 2006.
[25] Cooprider, J., et al., A collaboration model for ERP user-system interaction, in HICSS10 2010.
[26] Bradford, M. and J. Florin, Examining the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. International Journal of Accounting Information Systems, 2003. 4(3): p. 205-225.
[27] Elbertsen, L., J. Benders, and E. Nijssen, ERP use: exclusive or complemented? Industrial Management & Data Systems, 2006. 106(6): p. 811-824.
[28] Low, C., Y. Chen, and M. Wu, Understanding the determinants of cloud computing adoption. Industrial Management & Data Systems, 2011. 111(7): p. 1006-1023.
[29] Cooper, R. and R. Zmud, Information Technology Implementation Research: A Technological Diffusion Approach. Management Science, 1990. 3(2): p. 123-139.
[30] Chang, H.-H., et al., ERP Post-Implementation Learning, ERP Usage and Individual Performance Impact, in 15th Pacific Asia Conference on Information Systems. 2011: Brisbane, Australia.

[31] Gattiker, T.F. and D.L. Goodhue, What happens after ERP implementation on plant-level outcomes. MIS Quarterly, 2005. 29(3): p. 559-585.
[32] Bendoly, E. and F. Kaefer, Business technology complementarities: impacts of the presence and strategic timing of ERP on B2B e-commerce technology efficiencies. Omega, 2004. 32(5): p. 395-405.
[33] Rajagopal, P., An innovation-diffusion view of implementation of enterprise resource planning (ERP) systems and development of a research model. Information & Management, 2002. 40(87-114).
[34] Velcu, O., Exploring the effects of ERP systems on organizational performance: evidence from Finnish companies. Industrial Management & Data Systems, 2007. 107(9): p. 1316-1334.
[35] Chou, S.W. and Y.C. Chang, The implementation factors that influence the ERP (enterprise resource planning) benefits. Decision Support Systems, 2008. 46(1): p. 149-157.
[36] Wenrich, K. and N. Ahmad, Lessons learned during a decade of ERP experience: A case study. International Journal of Enterprise Information Systems, 2009. 5(1): p. 55-73.
[37] Quattrone, P. and T. Hopper, A 'time–space odyssey': management control systems in two multinational organizations. Accounting Organizations and Society, 2005. 30(7): p. 735-764.
[38] O'Leary, D., Enterprise resource planning: systems, life cycle, electronic commerce, and risk. 2000, Cambridge: University Press.
[39] Davenport, T.H. and J.G. Harris, Competing on Analytics: The New Science of Winning. 2007: Harvard Business School Press.
[40] Chiang, A., Creating Dashboards: The Players and Collaboration You Need for a Successful Project. Business Intelligence Journal, 2009. 14(1): p. 59-63.
[41] Dillman, D.A., Mail and Internet Surveys: The Tailored Design Method. 2nd Edition ed. 2000, New York.

Appendix. Items-questions

Factor	Questions	Literature support
Using a five-point scale, respondents were asked to rate their perception on…		
Compatibility	…is your ERP system compatible with others software's. …is your ERP system compatible with other hardware. …is your ERP system compatible with others networks.	Bradford and Florin; Elbertsen et al; Low et al [26-28]
Complexity (reverse code)	…how easy it is to learn. …intuitiveness of system. …comfortable they feel using it.	Cooper and Zmud; Kositanurit, et al; Chang, et al [13, 29, 30]
Efficiency	…user effectiveness in executing repetitive tasks. …efficiency of user interface. …speed and reliability of system.	Rajagopal, et al; Bendoly, et al; Gattiker and Goodhue [31-33]
Best-practices	…user's setup the application. …map workflows based on local requirements (VAT, SEPA). …system adaptability to business needs.	Chou and Chang; Wenrich and Ahmad; Velcu; Quattrone and Hopper [34-37]
Training	…be trained on the system. …understand the content material. …navigation thought the topics.	O'Leary; Bradford and Florin [26, 38]
Empowerment	…ease of comprehensive reporting (PKIs, Dashboards). …real-time access to information. …greater collaboration.	Calisir and Calisir; Gattiker and Goodhue; Davenport and Harris; [23, 31, 39, 40]