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Enterprise Systems: The Quality of System Outputs and their Perceived Business Value

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Keywords: Enterprise Systems, Business Value, System Characteristics, System Quality.

Abstract: Organizations are exploring the opportunities offered by information technology to reduce cost and improve overall performance and gain more efficiency. Enterprise Resource Planning Systems are viewed as powerful solutions that help improve productivity, performance and overall quality. However, effective use and beneficial outcomes from such systems are neither guaranteed nor recognized. This study aimed at evaluating the business value of ERP systems and perceived benefits at the user level. This short paper briefly presenting some empirical results related enterprise system impacts and benefits. The reported results in this paper are a part of a larger project investigating business value of Enterprise Resource Planning Systems (ERPs). The focus of this paper is on technical system factors including system features, system quality, information quality and their impacts on business value of ERPs perceived by system users on particular aspects such as efficiency, creativity and effectiveness.

1 INTRODUCTION

Organizations are exploring the opportunities offered by information technology to reduce cost and improve overall performance and gain more efficiency. ERP systems are viewed as powerful solutions that help improve productivity, performance and overall quality. However, effective use and beneficial outcomes from ERP systems are not guaranteed nor recognized by many organizations. Existing research investigating ERP investments and business value reported mixed results. Huge performance differences have been observed across ERP adopters, even for organizations in the same industry that adopted the same ERP systems from the same software vendors. This could be for many reasons, despite the fact that prior ERP productivity studies had their analytical rigor, they did not include user's factors and/or user evaluation of productivity impacts of ERPs. They are at best focused on firm and business environmental factors, thereby overlooking the impact of firm-specific features. This led to lack of research at the user level in this area where the actual benefits are valued, and/or ignorance of user evaluations of the ERP's impacts and benefits. Current research generally

considers system usage only as the dependent factor of system impacts without considering the perceived benefits recognized by individual users. Therefore, this paper is an attempt to broadly understand the user viewpoints about ERP systems and how these provide payback at the user level.

Prior research considered organizational benefits and impacts as a main business value of information systems, including financial, economic and market indicators that are usually measured at the organizational level. However, we conjecture that the central tool that creates and perceives the value and benefits from ERPs is the user. Unfortunately, user aspects such as user perception, evaluation and requirements in general did not receive enough attention from researchers. Furthermore, the history of ERP systems failures was partially attributed to the lack of fit between the systems and user needs and task requirements. For example, previous studies indicated that many large ERP projects fail due to the mismatch with user requirements and the inability to realize expected benefits and outcomes at the user level (Ahmad and Cuenda, 2013; Abugabah et al., 2015).

As a consequence, researchers and practitioners have a strong desire to investigate the causes and factors that lead to operational benefits of ERP

systems. Thus, studying perceived business value and benefits at the user level in ERP system environments will help clarify the complexity of the relationship between ERP systems and payoff of such system, with the assumption that ERP users are the ones who should be able to evaluate the systems and judge their values (Addo-Tenkorang and Helo, 2011; Matende and Ogao, 2013; Baykasoglu and Golcuk, 2017). Accordingly, this study used perceived user evaluation of system characteristics and system quality as a tool to evaluate ERP systems' business value in enterprises.

Research on IT payoff and productivity impacts of IT reported mixed results and in most cases these results were anecdotal and/or equivocal (Abdul Kadir et al., 2015; Hustad et al.2016; Parhizkar and Comuzzi, 2017; Abugabah and Alfarraj, 2015). A noteworthy of the main characteristics of previous studies clear dependence on particular environment and organizational measures and ignoring impacts resulted on other essential aspects at the either organizational unit levels or individual levels, such as IT on effectiveness, quality and customer satisfactions among others (Ahmed and Haddara, 2012; Alfarraj and Abugabah, 2017).

In the ERP context, the business value and impact of such systems deemed to be an important research topic that drawn a great amount of attention by both researchers and practitioners with a strong desire to identify the main contributions and benefits to these systems to organizations (Bokovec et al., 2015; Ala et al., 2010; Nwankpa, 2015).

2 STUDY DESIGN AND RESULTS

2.1 Research Model

The current study utilized a quantitative research approach and collected data from ERP users in the mean of survey questionnaires in healthcare industry. This study focuses on two main aspects of ERP system features including information quality and system quality and characteristics and how these aspects contribute to unrecognized business value from a user perspective. The study is a part of a larger study, which was conducted in healthcare organizations utilizing Enterprise Resource Planning Systems (ERP) with the aim of testing the impacts played by above mentioned factors and subsequent measures on user evaluation of the business value of ERPs implemented (Besik, 2006). Apart of the factors that were investigated in the whole project are illustrated in the figure below, representing one stage only of the study. The study factors and their proposed relationships in this stage are illustrated in figure 1.

2.2 Demographics of the Sample

As shown in Table 1, a total of 387 questionnaires were useable and were analysed for this study. The gender distribution was different to the general population, with 21.1% of the study sample being male, while 72.9% were female.

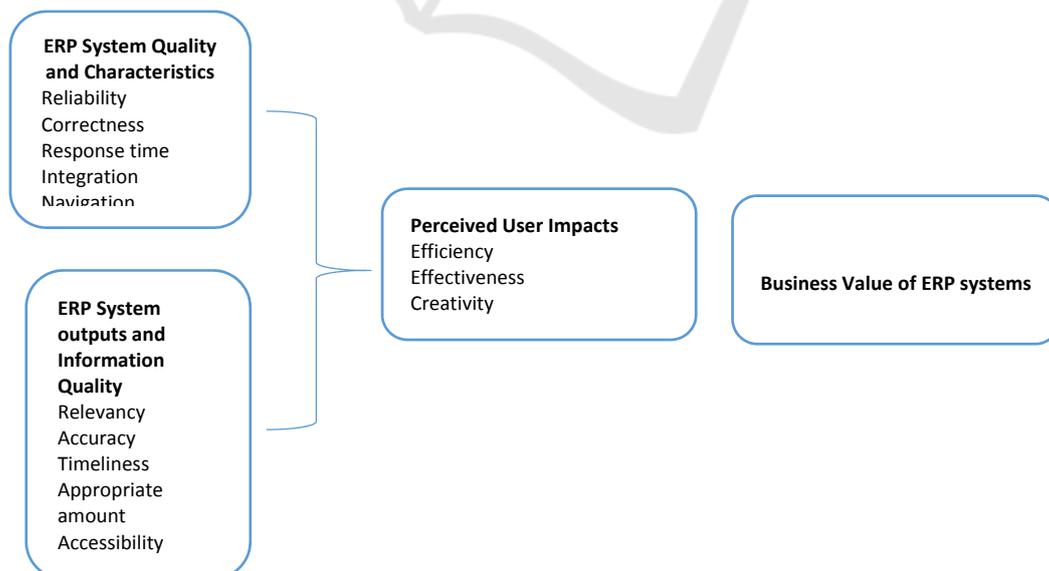


Figure 1: The study model.

Table 1: Demographics of the sample (N=387).

Factor	Classification	Freq	%
Gender	Male	105	27.1%
	Female	282	72.9%
Usage type	Once a week	25	6.5%
	Several times a week	47	12.1%
	Once a day	17	4.4%
	Regular use	298	77%
Experience with ERP	1-3 years	148	38.2%
	4-6 years	104	26.9%
	7-9 years	102	26.4%
	> 9 years	33	8.5%

Most of the study participants were regular users of ERP systems, using the systems on a daily basis (77% of the study sample), while 4.4% of the participants used the systems once a day, 12.1% of the users used the systems several times a week and 6.5% of the users used the systems once a week. In addition, 38.2% of the users had from 1 to 3 years' experience with the systems, 26.9% of the users had from 4 to 6 years' experience with ERP systems, 26.4% of the users had from 7 to 9 years' experience with the systems, while only 8.5% had more than 9 years' experience with ERP systems. This indicates that most participants of the study have an appropriate level of knowledge and usage of the system to evaluate the main benefits of reflect the real business value of these systems.

2.3 Validity and Reliability

Factor analysis was also conducted to measure scale validity and reliability. SQ measures including reliability, correctness, response time and integration. As shown in Table 2, all items have high loading with their respective factors. Thus, all items will be included in the analysis. Reliability was measured using Cronbach's alpha was found that all factors have high reliability. The alpha value was reported in brackets for each factor.

Factor analysis was conducted for information quality measures including accessibility, completeness and timeliness, but accuracy and relevancy were not included in the analysis as they were measured by two items only. The analysis was conducted with these two items and the results showed that these items were highly correlated, hence they were retained. As shown in table 3, most items have high loadings on their corresponding factors. Two items were dropped from any further analysis as they did not have high loadings with their respective factors. The results indicated a high degree of validity for items used to measure information quality and ERP outputs.

Table 2: Results of factor analyses of SQ.

Item	*/Factors loading ($\alpha = .78$)			
	Integ	Rel	Res	Corr
Integ2	<u>.782</u>	.198	.155	.154
Integ1	<u>.768</u>	.030	.167	.198
Integ3	<u>.581</u>	.140	.247	.257
Relia2	.143	<u>.832</u>	.185	.227
Relia1	.111	<u>.669</u>	.262	.173
Res2	.311	.321	<u>.749</u>	.215
Res1	.222	.245	<u>.733</u>	.241
Corr1	.285	.229	.210	<u>.754</u>
Corr2	.278	.272	.246	<u>.596</u>

*1. Integration, 2. Reliability, 3. Response time, 4. Correctness

Table 3: Factor analyses of IQ ($\alpha = .81$).

Item	Factors loading ($\alpha = .81$)		
	Access	Comple	Tim
Access2	<u>.827</u>	.268	.228
Access1	<u>.711</u>	.283	.332
Comple1	.400	<u>.500</u>	.302
Comple2	.409	<u>.416</u>	.164
Tim2	.247	.253	<u>.691</u>
Tim1	.336	.407	<u>.453</u>

Similarly, factor analysis was performed for perceived business value measures including efficiency, effectiveness and creativity (innovativeness). As shown in Table 4, all measures loaded highly on their respective factors indicating a high level of validity of the scale measures.

Table 4: Factor analysis for ERP business value.

Item	Factors loading ($\alpha = .83$)		
	Effici	Effec	Crea
Effici1	<u>.810</u>	.229	.253
Effici6	<u>.785</u>	.459	.202
Effici2	<u>.767</u>	.213	.363
Effici4	<u>.765</u>	.470	.165
Effici3	<u>.765</u>	.339	.241
Effici7	<u>.745</u>	.558	.233
Effici8	<u>.692</u>	.567	.276
Effici5	<u>.655</u>	.267	.337
Effec1	.412	<u>.715</u>	.434

Table 4: Factor analysis for ERP business value (cont.).

Item	Factors loading ($\alpha = .83$)		
	Effici	Effec	Crea
Effec2	.449	<u>.609</u>	.407
Effec3	.547	<u>.599</u>	.383
Crea1	.256	.234	<u>.914</u>
Crea1	.244	.256	<u>.833</u>

2.4 Analysis and Findings

Regression analysis was used to assess the impacts of system features and characteristics measures on perceived business value of ERP recognized by users. As shown in the 5, ERP system factors affect business value of ERP systems significantly and positively ($\beta = .697, P < .01$). The analysis revealed a regression function ($R = .643$). ERP users indicated that system features are critical factors that contribute to business impacts of ERP systems. The results indicated a significant relationship between system features and characteristics and business value of ERP systems as shown in table 6, confirming what DeLone and McLean (2003) proposed in their original model related to system impacts, and signifying the importance of ERP technical characteristics for users when evaluating such a system. By utilizing these advantageous features ERP users indicated that their task can be done easier and faster and they are able to provide solutions to daily routine problems more efficiently in addition to improving their ability in providing more creative ideas to complicated situations as the system provides complete and full information in timely manner.

Table 5: Results of regression analysis.

Factors*	B	S.E	β	R	R ²	F	Sig
Constant	.033	.189					.798
SQ: H ₁	1.23	.059	.697	.643	.586	516.4	.001
Constant	.450	.278					.190
IQ: H ₂	1.21	.076	.590	.678	.437	218	.002

In relation to the impacts of information quality and ERP outputs on perceived business value of ERP systems the relationship was found significant as the whole model was significant ($F = 198, R = .678, P < .01; R^2 = .437, \beta = .580$), as shown in the table 5. System outputs play a critical role in helping users perform their job and task efficiently. The format of the outputs, and the completeness of the information make their performance more effective. ERP system

stratifies a firm wide information needs and requirements and ensure that all needed information is available to those who need it when they need it. This becomes true as users indicated that accessibility of the information saves time and enhances task accomplishment. Furthermore, users also indicated that their performance efficiency and effectiveness have been significantly improved as a result of information completeness and updated in a timely manner.

3 CONCLUSIONS AND IMPLICATIONS

The findings demonstrated that ERP systems have significant benefits and impacts recognized by users. The results of the analysis showed that all factors contribute to perceived values of ERPs by users. Previous studies indicated that SQ and IQ are very important factors that affect benefits of use (Ifinedo and Nahar 2006).

ERP users reported significant improvement in process and task performed and experienced thereby increased efficiency of their work. Furthermore, system features contribute in enhancing quality and efficiency and help users being creative and able to solve problems and generate new ideas related to their work. The results provided a satisfactory level of fit between ERP systems and user requirements and work needs taking into account sophisticated characteristics of the systems. System compatibility and integration were found to be essential for users and help improve the impacts of the system in a remarkable way. Therefore, system vendors and designers should always consider such characteristics when developing and designing the system package in different industries to fit exactly the business process, user needs and task requirements as well as different types of users.

Prior research highlighted the importance of the fact that organizations are willing to continue implementing ERP systems, if perceived benefits surpass perceived risks and costs. Therefore, these organizations must look into benefits gained at the user level and mining ERP users' perceived benefits, in order to evaluate the actual ERP project and their payoff. As such, this study offers a useful approach towards understanding the business value and benefits of ERP systems and the payoff of system usage at the user level by covering relatively different factors to evaluate the actual individual impacts received by different types of ERP users.

This study highlights some more clarifications and about the potential benefits of the ERP's outputs for users in business organizations. This is becoming important as organizations are spending huge amounts and countless hours in adopting and installing ERPs. The study is deemed to be useful in explaining how users perceive information systems value and draw practitioners and researchers' attention to consider other factors such as users beliefs, evaluation and values recognized by users when evaluating IT implementations and projects payoff, not only financial, economic and marketing measures and how business values can be obtain from ERP systems.

Like other studies, this study has some limitations. Firstly, factors included in this study deemed to be important. However, other factors not covered in this study might be also important and contribute significantly to system value and impacts such as usage types, user jobs and managerial levels. Notwithstanding of the relationships between ERP systems' factors and business value and user evaluation, such relationships may not apply to other environments. Therefore, it would be useful to determine if these relationships will work in the same way in different industries with different types of users. Lastly, the results reported in this study and the factors included in the study model represent only a part of a larger undergoing project investigating the value of ERP systems in health care organizations.

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