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Research paper



The Enterprise Resource Planning System and Human Influences on Perceived Business Benefits

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Abstract

Strategic information systems are designed to support business processes for firms to achieve competitive advantage in the market place. Enterprise Resource Planning (ERP) system is one such example of a strategic information system. While there have been many researches on ERP systems, evidence about ERP systems business benefits from user's perspective still remains to be known. The research, therefore, aims at exploring and determining the influences of ERP systems on business benefits. The influences encompass the user satisfaction with the ERP system itself (system factor) and the human factor of service provider as perceived by users. The human factor is made up of the perceived service quality of provider as consultant and the relationship quality between the user and the provider. Data was collected using a survey research instrument from three different organizations in Malaysia. A total of 120 users provided responses to the survey. The research provides support for the ERP system and human influences on user's perceived business benefits. Implications of the research are discussed herein.

Keywords: *Strategic Information Systems; Enterprise Resource Planning Systems; Exploratory Analysis; Survey Research*

1. Introduction

Strategic information systems are designed to support business processes for firms to achieve competitive advantage in the market place. One such example of a strategic information system is the Enterprise Resource Planning (ERP) system.

In 2013, Gartner [1] predicted that the enterprise sales of ERP systems would grow to $32.9 billion by 2016, attaining a 6.4% CAGR for the forecast period from 2011 to 2016. More recently, the Allied Market Research [2] forecasts that the global market sales for ERP expects to reach $41.69 billion by 2020. This would record a CAGR of 7.2% for the period 2014-2020.

ERP is widely used in firms of advanced economies [3]. In Malaysia, the literature on ERP implementation continues to be limited in comparison to other developed nations. A recent Google Scholar search conducted using ERP and Malaysia in article title yielded 17 hits. Another search but using Enterprise Resource Planning and Malaysia yielded seven hits only.

2. Literature Review

The evolution of ERP system started in the 1960s. At that time, organizations' main focus was on inventory management and control. This could include identifying the requirements of inventory, setting targets of stock, providing stock refill techniques and alternatives, observing stock usages, reconciling the inventory balances, and reporting the inventory status if necessary. Cost is a key focus in achieving competitiveness [3]. This decade saw organizations managing high-volume production, cost minimization, and large inventories [4]. Software packages were individually developed in order to automate inventory on the basis of traditional inventory concepts [5, 6].

In the 1970s, with the realization that organizations could not afford to always maintain large volume of stocks in their inventory, the Material Requirements Planning (MRP) systems were introduced. Computers were used to estimate gross material requirements based on a Master Production Schedule (MPS) along with the Bill of Material (BOM) which essentially identified the materials required to produce each finished product. Furthermore, by referring to the exact inventory record files from the system, the net material requirements could be calculated based on available quantity on-hand or scheduled-to-arrive materials. Consequently, organizations could carry out activities such as placing an order if the quantity on-hand was insufficient, cancelling an existing order if the amount on-hand was too many, or even modifying the timing of existing orders as they wished. The ability of such systematic and efficient planning enables attaining productivity and quality for organizations [7].

In the 1980s, the MRP system evolved into a standard Manufacturing Resource Planning (MRPII). The system emphasized on optimizing the manufacturing process by synchronizing materials with production requirements. Because of the changing of scope in software applications, there was a change in manufacturing theory as well. Organizations started to give greater focus on quality aspect. Manufacturing strategy focused on process control, closed-loop scheduling, reduced overhead costs, enhanced shop floor reporting, and detailed cost reporting [8]. MRP II was integrated with the financial accounting system and the financial management system along with the manufacturing and materials management systems [4].

The early 1990s saw the emergence of the ERP systems. Continuous improvements in technology allowed MRPII to be extended to integrate all resource planning processes for the entire organiza-

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tion. An ERP system includes relational database management, graphical user interface, and client-server architecture. The system was to enable product design, information warehousing, materials or capacity planning, communication systems, human resources, finance, and project management. It could be used not only in manufacturing organizations, but in any organizations that aims at enhancing competitiveness through effective assets utilization, including information [5, 6].

Initially, ERP systems focused on back office functions. Front office functions such as Customer Relationship Management (CRM), Supplier Relationship Management (SRM), or e-Business systems later became integrated through the Electronic Data Interchange (EDI) technology. The early 2000s marked the advent of the "ERPII", which was web-based. Both employees and partners such as suppliers and customers were allowed real-time access to the system. Information is updated and transmitted almost instantly. This marks ERP as an integrated solution. The manufacturing processes are integrated with the supply chain processes across the organization. It is designed to integrate the organization's business processes to create seamless information flow beginning with suppliers, going through the manufacturing process, and finally ending with the customers [8].

Since the 1990s, the ERP has been generally identified as an integrated technology solution that allows information to be shared within an organization. Nah and Lau [9] defined the ERP system as a packaged system that enables an organization to manage the efficient and effective use of resources such as materials, finance, human resources, etc. by providing a total, integrated solution for the organization's information-processing needs. At the same time, Hecht et al. [10] defined the ERP system as integrated software which consists of numerous modules that share a central database. It helps an organization to automate and integrate business processes and practices internally, besides providing support for main organizational activities such as sales, marketing, manufacturing, procurement, finance, accounting, and human resources.

Due to a large investment required in implementing ERP system, its potential benefits continue to attract debates among researchers [11, 12, 13]. While James and Wolf [14] suggested that organizations would be initially unable to identify the benefits of an ERP system and predict its business value, others explored the relationship between user adaptation and ERP system benefits [13], and between ERP system benefits and business intelligence readiness [12]. As prior researches indicate, the complexity of ERP system implementation is often attributable to the intricacies of the system itself and the underlying organizational issues beleaguering such implementation [9].

3. Problem Statement and Research Objective

The implementation of ERP in organizations is not without challenges. Organizations planning to embark on an ERP project have to ensure that they are ready, notably, in terms of managing the system functions and the human factors. While there have been many researches on ERP systems, evidence about ERP systems business benefits from user's perspective still remains to be known. The influences of ERP systems on business benefits continue to be unclear. This is evident as the researchers acknowledge that research on ERP system in Malaysia continues to be sparse.

The present research seeks to contribute to research on ERP system. In particular, the research aims at exploring and determining the influences of ERP systems on business benefits, notably, in the Malaysian business environment.

4. Method

This section discusses the method used in the research and comprises four parts. Part one of the section offers highlights on the variables, hypotheses and research model. Part two presents the research instrument. Part three discusses the population and sample while part four is about the pilot test.

The research question that has been set out: **What are the influences on the perceived ERP system business benefits?** In answering the question, the researchers seek to determine whether the system functions and human factor influence the user's perceived ERP benefits.

The system functions are measured through user's satisfaction with the ERP system. The human factors are measured through user's perceived quality of consultant's service and relationship with the consultant. The consultant is the service provider of the ERP system. The perceived benefits cover individual and organizational impacts of the ERP system.

4.1. Variables, Hypotheses and Research Model

This part discusses the variables used in the research. The researchers define the dependent variable as user's perceived ERP benefits (ERP impacts on individual and organization). The independent variables in the research comprise user satisfaction, perceived service quality of consulting provider and relationship quality between users and service provider (consultant or consulting provider of the ERP system).

Doll and Torkzadeh [15] defined the end user computing satisfaction (EUCS) as the affective attitude toward a specific computer application of someone who interacts with the application directly. User satisfaction comprises user's satisfaction with information content, accuracy of information, output format, ease of use, and timeliness of information.

Previous research has shown the impact of user satisfaction on system usage in m-banking environment [16]. User satisfaction has been found to mediate the relationship between perceived net benefits, system quality and service quality; and moderate the effects of system quality and service quality on perceived net benefits [17]. Therefore, the research hypothesizes that:

H1: User satisfaction influences perceived ERP system business benefits.

The consulting provider is the second variable considered in the research. Firms use external consultants to provide assistance in the ERP selection, implementation process, and technical evaluation of the chosen solution. Consultants render technical assistance, and domain knowledge as they work with clients on emergency maintenance, updates, service responsiveness, solutions provision, design, customization support, and user training [18].

Consultants are typically well trained in ERP implementation methodologies, and possess system deployment experience. Prior research suggests that the consultant's domain knowledge affects the system implementation [19]. Consultants transfer knowledge and business practices to their clients, so they must have system knowledge and industry specific expertise [20]. Moreover, the transfer of consultant's implementation knowledge is perceived to fulfill client's needs, respond to changing business processes, conduct ongoing administration and maintenance, minimize duration of training, gain new in-house capabilities, and deploy a high-quality system [21]. As the role of consultants is to provide services to clients, the research hypothesizes that:

H2: ERP consultants influence user's perceived ERP system business benefits.

Crosby et al. [22] stated that when customers purchase products, they would often feel uneasy and uncertain. If the customer perceived a good relationship quality between the customer and seller, uncertainty could be reduced. Trust is usually seen as a crucial element for building and maintaining successful relationships. Satisfaction is a measure of how a customer's expectations are met and often has been perceived as the final result of all activities carried out during the process of purchase and consumption [23]. The research posits that:

H3: Relationship quality between user and ERP provider influence user's perceived ERP system business benefits.

Figure 1 shows the research model.

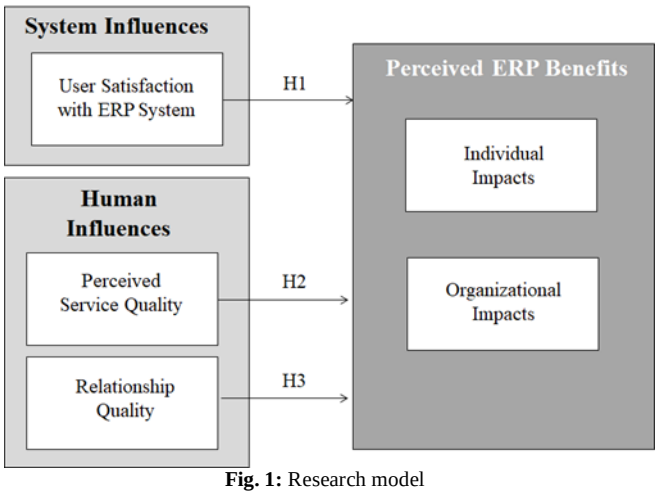

Fig. 1: Research model

4.2. Research Instrument

The researchers adopted and adapted prior measures in developing a survey research instrument for data collection purpose. Table 1 shows the measures and sources for the instrument.

Table 1: Measures and Sources of Research Instrument

Measure	Definition	Source	Survey Item
Perceived ERP benefits (PB)	Business benefits that can be achieved from the use of ERP system	[24]	• Cost reduction • Cycle time reduction • Productivity improvement • Quality improvement • Better resources management • Improved decision making and planning • Performance improvement in a variety of ways in all levels of the organizations • Support business growth • Building cost leadership • Generating product differentiation • Generating or sustaining competitiveness • Changing work pattern with shifted focus • Facilitating business learning and broaden employee skills • Empowerment • Building common visions • Increased employee morale and satisfaction
User satisfaction (US)	The affective attitude towards a specific computer application of someone who interacts with the application directly.	[15]	• Does the system provide the precise information you need? • Does the information meet your needs? • Does the system provide reports that seem to be just about exactly what you need? • Does the system provide sufficient information? • Is the system accurate? • Are you satisfied with the accuracy of the system? • Do you think the output is presented in a useful format? • Is the output information clear? • Is the system user-friendly? • Is the system easy to use? • Do you get the information you need in time? • Does the system provide up-to-date information?
Perceived service quality of consultant (SQ)	The overall support delivered by the service supplier.	[25]	• Consultants provide up-to-date hardware and software. • Consultants are reliable. • Consultants provide prompt service to users. • Consultants have the knowledge to do their job well. • Consultants have users' best interests at heart.
Relationship quality (RQ)	The overall assessment of the strength of a relation-ship between two parties.	[22]	• The service provider honors its commitment. • I trust the service provider. • I am satisfied with the service provider. • I am satisfied with the relationship between me and the service provider.

For all of the above measures, the research used a five point Likert scale. For perceived ERP benefits, perceived service quality and relationship quality measures, a 5-point represents strongly agree while a 1-point represents strongly disagree. For user satisfaction, however, a 5-point signifies almost always, a 4-point denotes most of the time, a 3-point represents about half of the time, a 2-point denotes some of the time while a 1-point is almost never.
The research instrument was divided into five parts. Part A requires respondents to provide demographic information. Nominal scale was used in this part of the questionnaire. The subsequent parts contain items on the above measures.

4.3. Population and Sample

Data was collected from three different organizations (labelled A, B, and C). The population of respondents comprises the users of the ERP system for all organizations. Users would be at the executive level or above. The sample was selected using convenient sampling technique where key respondents using the system in support of operational and managerial decision-making were the target. Table 2 shows the representation of each of these organizations.

Table 2: Population and sample

Organization	Estimated no. population	No. of sample	Percentage
A	45	40	33.3
B	45	40	33.3
C	45	40	33.3
Total	135	120	100

4.4. Pilot Test

A pilot test was commissioned for the above instrument considering that it has not been used in the Malaysian business environment. A total of 40 respondents participated in the pilot test. Results of the pilot test are in Table 3.

Table 3: Pilot test results

Measures	No. of items	Cronbach Alpha (α)
User Satisfaction	16	0.930
Service Quality	12	0.902
Relationship Quality	5	0.950
Impact	4	0.915

One commonly used method to assess the internal consistency reliability is Cronbach's alpha. The coefficient alphas greater than .70 indicated reliable constructs [26]. Therefore, the researchers did not make any modifications to the instrument. The questionnaire was distributed to the targeted sample. Data was analyzed using SPSS Version 20.

5. Findings

This section presents the findings. There are five parts. Part one discusses the profile of variables. Part two presents the factor analysis. Part three highlights a re-specification of hypotheses and research model as an outcome of the factor analysis. The reliability analysis is in Part four. Consequently, correlation and regression analysis are presented in the last part.

5.1. Profile of Variables

Table 4 shows the profile of variables.

Table 4: Profile of variables

Measures	Mean score	Standard deviation
PB1	3.17	1.007
PB2	3.30	0.826
PB3	3.23	0.923
PB4	3.40	0.803
PB5	3.43	0.807
PB6	3.63	0.879
PB7	3.57	0.719
PB8	3.53	0.809
PB9	3.20	0.795
PB10	3.47	0.721
PB11	3.50	0.767
PB12	3.37	0.840
PB13	3.53	0.809
PB14	3.40	0.803
PB15	3.40	0.760
PB16	3.23	0.807
US1	3.67	0.911
US 2	3.60	0.920
US 3	3.27	0.968
US 4	3.67	0.873
US 5	3.87	0.849
US 6	3.77	0.923
US 7	3.37	0.879
US 8	3.53	0.849
US 9	3.13	1.122
US 10	3.10	0.947
US 11	3.67	0.833
US 12	3.70	0.826
SQ1	3.33	0.833
SQ2	3.73	0.857
SQ3	3.63	0.879
SQ4	3.70	0.826
SQ5	3.43	0.847
RQ1	3.43	0.847
RQ2	3.47	0.766
RQ3	3.37	0.798
RQ4	3.40	0.803

n=120

Table 4 shows that the lowest mean score is US10 (mean=3.10) while the highest mean score is US6 (mean= 3.77). The subsequent procedure makes use of factor analysis.

5.2. Factor Analysis

Factor analysis was performed for the human and system measures as independent variables. These are separated from the dependent variables. The criteria used in the research are:

- Eigenvalues greater than 1.0
- Extraction Method: Principal Component Analysis
- Rotation Method: Varimax with Kaiser Normalization

A cut-off point of 0.6 is used for consideration of further data analysis in view of the sample size. If an item does not meet the cut-off point, measure is dropped from further analysis.
Table 5 shows the factor analysis results for the independent variables.

Table 5: Factor analysis for independent variables

	1	**2**	**3**
US1	0.523	**0.653**	0.135
US 2	0.419	0.587	0.334
US 3	0.156	**0.842**	0.103
US 4	0.417	**0.679**	0.262
US 5	0.331	**0.644**	0.566
US 6	0.262	**0.721**	0.299
US 7	0.423	**0.769**	0.099
US 8	0.350	**0.765**	0.319
US 9	0.129	0.258	**0.929**
US 10	0.349	0.272	**0.805**
US 11	0.399	**0.781**	0.374
US 12	0.578	0.249	0.467
SQ1	**0.800**	0.329	0.233
SQ2	**0.810**	0.435	0.070
SQ3	**0.869**	0.201	0.110
SQ4	**0.778**	0.197	0.309
SQ5	**0.741**	0.403	0.231
RQ1	**0.757**	0.470	0.209
RQ2	**0.824**	0.246	0.346
RQ3	**0.764**	0.451	0.246
RQ4	**0.805**	0.452	0.118

Based on Table 5, items that meet the cut-off point are highlighted in bold. Two items do not meet the cut-off point. They are item US2 (*Does the information meet your needs?*), and item US12 (*Does the system provide up-to-date information?*). These are not considered in further analysis. All the items for service quality and relationship quality loaded onto factor one. This suggests they are all human factor as hypothesized. The end-user-satisfaction items loaded onto factor 2 and factor 3. Because the end-user-satisfaction were originally hypothesized into one, and yet the result suggests two factors, a correlation for the summated scale is carried out to determine if they can further be considered as one.
A summated scale was performed by averaging out the valid items in factor 2 and factor 3. The correlation score for the two factors were all above 0.602. As a result, they were treated as one factor and denoted as user satisfaction with ten items.
The subsequent procedure was to determine the factor for the perceived ERP benefits. Table 6 shows the factor analysis results.

Table 6: Factor analysis for dependent variable

	1	2
PB1	0.073	0.910
PB2	0.216	0.891
PB3	0.517	0.674
PB4	0.734	0.442
PB5	0.646	0.631
PB6	0.761	0.210
PB7	0.565	0.615
PB8	0.588	0.568
PB9	0.877	0.171
PB10	0.709	0.477
PB11	0.848	0.195
PB12	0.752	0.361
PB13	0.601	0.621
PB14	0.662	0.467
PB15	0.505	0.752
PB16	0.524	0.655

Items that meet the cut-off point are highlighted in bold. One item does not meet the cut-off point, i.e. item PB8 (*support business growth*). Another item that is omitted is PB13 (*facilitating business learning and broaden employee skills*). For both items, the factor loading exceeded 0.6 in both factor 1 and factor 2; there is a doubt as to which factor the item belongs to. So the item is omitted from further analysis. Because the business benefits items loaded onto factor 1 and factor 2, a correlation for a summated scale is carried out to determine if they can further be considered as one.

A summated scale was performed by averaging out the valid items in factor 1 and factor 2. The correlation score for all items were 0.788. As a result, they are treated as one factor to denote perceived benefits of ERP system with fourteen items.

5.3. Re-Specification of Hypotheses and Research Model

The factor analysis outcomes demonstrate that the research hypotheses and research model require a re-specification. Therefore, the hypotheses are modified accordingly:

H1: User satisfaction with ERP system influences perceived ERP benefits.

H2: Service provider's human factors influence user's perceived ERP benefits.

The re-specified research model is in Figure 2.

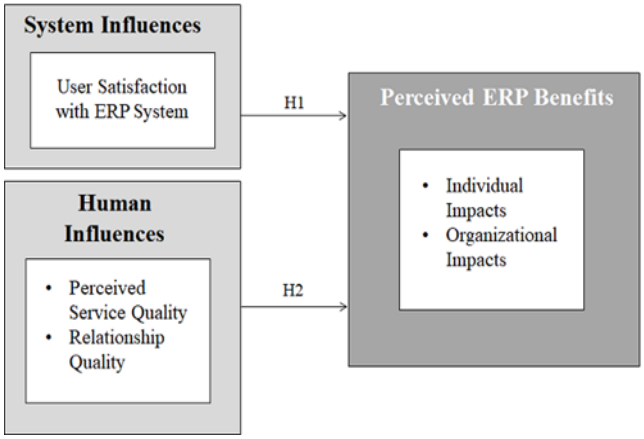

Fig. 2: Re-specified research model

5.4. Reliability Analysis

Reliability analysis for both the human and system measures and perceived benefits of ERP system were conducted. One commonly used method to assess the internal consistency reliability is Cronbach's alpha. The coefficient alphas greater than 0.70 indicated reliable constructs [26]. The results of reliability analysis are in Table 7.

Table 7: Reliability analysis

Measures	No. of items	Cronbach Alpha
Perceived benefits	14	0.956
User Satisfaction	10	0.943
Service Quality & Relationship Quality	9	0.969

The results indicate that all measures are reliable.

5.5. Correlation and Regression Analysis

The researchers created summated scales based on factor analysis and reliability analysis results. Summated scale averages out the items from each factor as identified in prior analyses. A correlation analysis was run among user satisfaction, service quality and relationship quality, and perceived business benefits.

Table 8: Correlation analysis

	US	SQ+RQ	PB
US	1	0.774**	0.688**
SQ+RQ	0.774**	1	0.663**
PB	0.688**	0.663**	1

** Correlation is significant at the 0.01 level (2-tailed).

The results show that they are all correlated to each other. Moreover, the correlation is strong for the link among user satisfaction, service quality, and relationship quality. The rest are moderate correlation. Consequently, the researchers ran the regression analysis (Table 9a and Table 9b).

Table 9a: Regression analysis

Model	Unstandardized coefficients		Standardized coefficients	T	Sig.
	B	Standard error	Beta		
1 (Constant)	1.036	0.214		4.832	0.000
US	0.381	0.089	0.435	4.277	0.000
SQ+RQ	0.288	0.090	0.327	3.214	0.002

a. Dependent Variable: PB

Table 9b: Regression analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.718a	0.515	0.507	0.45951

Table 9a indicates that system (through user satisfaction) influences are significant ($p<0.01$) in perceived benefits of ERP system. Further, human influences are significant ($p<0.01$) in perceived benefits of ERP system. Tables 9b suggest that 51.5% of perceived benefits of ERP system can be explained by user satisfaction with the system and the perceived service quality and relationship quality with consultants.

Following the above findings, the final research model is as shown in Figure 3.

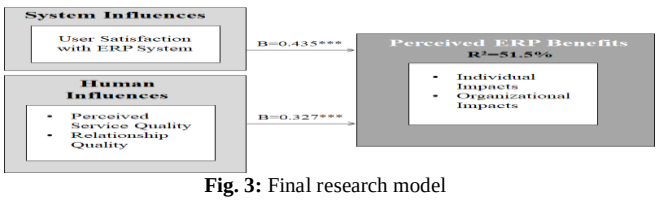

Fig. 3: Final research model

6. Conclusion

This section discusses the summary of findings, research contributions, limitations of the research, and offers areas for future research.

6.1. Summary of Findings

At the onset of the paper, the researchers pose the following research question: ***What are the influences on the perceived ERP system business benefits?*** In answering the question, the research uses user's satisfaction with the ERP system to conceptualize the system influences. The research adopts the user's perceived quality of consultant's service and relationship with the consultant to conceptualize the human influences. The perceived benefits cover individual and organizational impacts of the ERP. Findings show that users are satisfied with the ERP when they are satisfied with the information content, accuracy of information, output format, ease of use, and timeliness of information of the ERP system. Likewise, users are not satisfied with the ERP when they are not satisfied with the information content, accuracy of information, output format, ease of use, and timeliness of information of the ERP system. Further, users' perception of consultant's service quality and relationship quality explain their perceived benefits. Perceived benefits include impacts on individual user and organization.

6.2. Research Contributions

The research has contributed to the literature by developing and testing a research model that explains user's perceived benefits of ERP system. The research reaffirms the measures for system and human influences besides the perceived ERP benefits. From practical standpoint, managers could use the measures to determine the influences of the ERP system and to measure the perceived benefits of the ERP system.

6.3. Limitations of Research

Potential bias might exist. The research relies on perceptual inputs from respondents. It could be a source of bias. Data was collected using convenient sampling which might not be representative of each participating organizations.

6.4. Future Research Areas

Future research could explore the system and human influences in other organizations and use probability sampling. Further, researchers could investigate the effects of different culture on the influences on perceived ERP benefits.

Acknowledgement

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