The alignment between Technology Innovation Effectiveness and Operational Effectiveness: Leading to improved operational performance.

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ABSTRACT

Organisations are increasingly investing in complex technological innovations, such as enterprise information systems, with the aim of improving the operation of the business, and in this way gaining competitive advantage. However, the implementation of technological innovations tends to have an excessive focus on either technology innovation effectiveness (also known as system effectiveness), or the resulting operational effectiveness. Focusing on either one of them is detrimental to the long-term performance of the enterprise and a failure to achieve the real value of technological innovations. As current literature is silent in regard to the alignment between technology innovation effectiveness and operational effectiveness, this research uses a combination of qualitative and quantitative, three-stage methodological approach to investigate the factors that influence the alignment between technology innovation effectiveness and operational effectiveness. Initial findings suggest that factors such as quality of information and quality of the service due to technology innovation effectiveness, and quality and speed from operational effectiveness are important and correlated factors that promote alignment between technology innovation effectiveness and operational effectiveness. In addition, multiple regression analysis has been used to identify the structural relationship and provide an explanation of the alignment between technology innovation effectiveness and operational effectiveness that leads to improved operational performance. This research is part of a broader study that examines the benefits of technological innovations in organisations in Australia.

Keywords: Technological innovation, system effectiveness, operational effectiveness, information systems alignment

INTRODUCTION

Innovative organisations are those that are able to use innovation to improve their practices, processes, systems or services [23]. Organisations are faced with competitive pressures to improve efficiency and productivity through technological innovation [8]. In addition, organisations need to respond to market changes through product or service innovation as performance improvement is derived, in large measure, from innovation [23]. Many service organisations are investing substantial resources in technological innovation such as enterprise information systems (EIS) to reengineer their processes, but the extent to which these technology innovations assist organisation to improve the operational performance is not yet well understood [13].

It is important to gain a better understanding of stakeholder's expectations in regards to the operational performance, and how a firm's innovation in the implementation of EIS can improve operational effectiveness, because such understanding can enhance an organisation's competitive advantage [21]. Previous studies [10] [11] point to the importance of implementing measures of business processes. These studies also found that the majority of performance indicators that companies have in place are financial ones and non-financial aspects are partially measured but often they are not an integral part of the monthly or annual reporting. Although innovation is vital for many service delivery organisations, very little emphasis is put on the measurement of the expected operational performance improvements [11]. Improving operational effectiveness involves determining key performance objectives and establishing benchmarks. Furthermore, some organisations are failing to benefit from the implementation of technology innovations because they either do not measure performance or what they do measure is inappropriate [24]. On the other hand, effectiveness needs to be measured from an information systems (IS) perspective as organisations need to better understand if the EIS they have implemented has contributed to achieving the expected organisational goals and benefits, or how far the EIS is from the reality of the needs of the organisation

The dualism between the formulation and implementation of EIS, leads us to investigate the alignment between system effectiveness and operational effectiveness that needs to exist in any organisation after the implementation of an EIS. As the current literature is silent in regard to such interactions, this research proposes to address the question 'Which factors are the best predictors of improvement in operational performance when technological innovations are adopted?'. In answering this question, this research uses both qualitative and quantitative approaches, based on unstructured and structured interviews with employees at different levels in service organisations that have implemented EIS and analyses the results of a survey of employees in organisations from the electricity distribution and retailer sector and higher education sector. Thus, the aim of this research is to build on the existing literature and to further confirm and refine a theoretical framework.

BACKGROUND

Operational Effectiveness

In order to respond to changing market conditions, organisations need learning processes to build the flexible capability to reconfigure and transform their processes. In dynamic and unstable environments firms constantly scan their environment and develop agile behaviours or competencies to rapidly accomplish changes [22]. In addition, an increasing number of factors are prompting organisations to operate more efficiently and to ensure they have effective operational processes [6] [21]. This involves the delivery value-adding products or services of exceptional quality, on time, at a competitive price. Organisations attempting to meet these objectives need to pay attention to their operational effectiveness as this is a primary driver of business performance [21].

Operational effectiveness is the ability to establish processes, based on core capabilities within the organisations, which work well [16]. Operational effectiveness involves improving process performance by leading and controlling the processes within the firm as well as measuring and improving the processes. A better use of resources through these core processes enables the organisation to eliminate waste, reduce costs, adapt more appropriate technology innovation and therefore perform better than competitors [16]. By studying how a firm performs the primary and supporting activities for service delivery, a firm can determine how it can add value at every stage of the service delivery process, and find ways to continuously improve processes while meeting operational performance objectives.

The five performance objectives an organisation must to fulfil to attain operational effectiveness include cost, quality, flexibility, speed and reliability [6]. Improving cost performance means that an organisation eliminates waste which comes from inefficiencies attained in processes such as purchasing, production, and staff performance. An appropriate disaggregation of the cost components impacting on the total cost performance of an organisation provides the opportunity to identify the areas for improvement [21]. Furthermore, improving on quality provides an opportunity to bridge the gap between what organisations are capable of offering and what customers demand. That is, viewing quality as a consistent provision of services that satisfy customers rather than simply conforming to specifications without any clear continuous improvement. The third operational performance objective consists of being flexible, this includes an organisation's ability to adjust to changes in response to customers' needs [20]. Additionally, improving on speed enables an organisation to shorten the time between the service request and delivery of the service, with the frequency, and at the time, that a customer requests [6]. Finally, reliability requires that an organisation's processes consistently perform as expected over time. That is, customers are satisfied by organisations that provide services that do not fail over a period of time or with services that are delivered as agreed [16].

System effectiveness

System effectiveness can be described as the extent to which information systems contribute to achieving organisational goals and benefits [2]. Companies deriving the greatest benefits from their systems are those that, from the start, view them primarily in strategic and organisational terms. These companies stress the importance of operational effectiveness, not the system. However, the high failure rate in implementing such systems is a major concern [1]. The medical informatics literature presents, by and large, a picture of successful implementation of health information systems (HIS). Nevertheless, the current literature fails to report the failures found after implementation of information systems [5]. Failure rates for large-scale system development projects are extremely high and many information system projects are failing to achieve their stated outcomes [9]. However, as it is difficult to quantify, the real level of information system failure it could be far greater than reported [9]. This prompts the need for a better understanding of the measures that assist managers in assessing the performance and benefits of an EIS through the evaluation of its dimensions.

The revised DeLone and McLean model [2] includes six interrelated dimensions of information systems success: information quality, system quality, service quality, intention to use, user satisfaction, and organisational impact, as dimensions that can be used to measure the dependent variable IS effectiveness. In the DeLone and McLean's model, system quality measures technical efficacy – the desired characteristics of the system. This assessment is based on the performance and productivity of the system. Information quality is the measurement of output from EIS. It measures semantic success – characteristics of the information and its desired form; the degree to which information produced has the attributes of content, accuracy, and format required by the user. Service quality is the level of service received by the users of EIS and the manner in which the service is provided by the IS department as it influences the degree of user satisfaction with an EIS. Use and user satisfaction measure effectiveness success through studies that attempt to analyse and measure the interaction of the information product with its recipients, the degree to which the user believes that using a particular system has enhanced his or her job performance. User satisfaction is defined as the user's response to the use of the output of an EIS, the psychological state after the use of an EIS. Individual impact is the effect the information has on the behaviour of the user, including improving personal or departmental performance, relating to what influences the information product has on management decisions. This impact occurs when the information is received and understood by the users and applied to their jobs. Organisational impact derives from research that investigated the effect of the information products on organisational performance [2] [14] [17].

In measuring performance it is important to have a clear understanding of the outcomes from the investment of a significant amount of human and economic resources in EIS solutions that cannot always be properly adapted to particular circumstances. Management accounting systems have been traditionally used to measure performance which focuses on data such as profit, return on investment and cash flow. These types of measures merely rely on financial performance and do not reflect the requirements that an organisation must fulfil in today's competitive business environment, or operational requirements. EIS effectiveness should be measured in terms of the real operational benefits rather than through the achievement of information systems outcomes alone.

Thus, the main purpose of this research is to build on and extend the existing literature and to put forward a theoretical framework that examines the following three propositions:

1. That there is a correlation between dimensions of system effectiveness and operational effectiveness
2. That a limited number of factors have the potential to explain the alignment between system effectiveness and operational effectiveness
3. That the emerging factors explain the interrelatedness between system effectiveness and operational effectiveness.

RESEARCH ISSUES AND METHODOLOGY

Given the exploratory nature of this research, a combination of qualitative and quantitative methods has been used. The first stage consisted of unstructured interviews to identify preliminary issues and variables that were then investigated in more detail using semi-structured interviews [18]. To provide triangulation, company documentation related to the information strategy, implementation and post implementation reports were analysed. The sample was purposive and was selected in order to cover a range of possible viewpoints and all of the interviewees are users of EIS applications. The stakeholders interviewed and targeted in the survey instrument include managers, engineers (technologist), and administrative and operational staff in the organisations as, according to Orlikowski & Gash [3], different actors in an organisation have different assumptions, expectations, knowledge and perceptions of EIS application. Such interpretations of technology innovation, called technological frames, are central to understanding technological development, use, and change in organisations as they critically influence the way people act around technology innovation. Orlikowski & Gash [3] also suggest that where the technological frames of key groups in organisations such as managers, engineers, and users, are significantly different, difficulties and conflict around the development, use, and change of technology can result. Thematic analysis was used to identify factors relevant to the research [12] [18] and allow the researchers to identify the organisational factors that influence the effectiveness of EIS implementation and also the operational performance objectives and dimensions that were used in the construction of the questionnaire.

In the second stage, data was gathered through a self administered questionnaire. The questionnaire was administered to employees and managers in organisations from the electricity distribution and retailer sector and from the higher education sector that had recently implemented an EIS. In the process of constructing measures of key variables and refining the survey instrument, we developed four pilot tests that enabled us to introduce a number of revisions that were carried out to improve the survey instrument between the initial draft and the final instrument. The final questionnaire is divided into three sections. The first section is used to identify the background, the areas of responsibility and involvement of the respondent in the use of EIS applications. The second section is related to technology innovation effectiveness and the third one is related to operational effectiveness.

Nineteen questions constitute the second section (technology innovation effectiveness) and the questions were selected from three previous studies mentioned in the DeLone and McLean [2] ten-year update as an appropriate empirical test and validation of the DeLone and McLean IS success model. The studies were conducted by Seddon and Kiew [19], Rai, Lang and Welker [17] and finally from Pitt, Watson & Kavan [15] all of the studies examined aspects of EIS effectiveness. Rai, Lang and Welker [17] believe that there is a danger that IS researchers will mismeasure IS effectiveness if they do not include in their assessment package a measure of IS service quality. They concluded that the effectiveness of an IS unit can be partially assessed by its capacity to provide quality service to its users. This supports our decision to include service quality measures in the questionnaire. Further more, this argument is supported by the findings in the first stage-interviews where interviewees identified some nonconformities and complaints concerning the service from the IS department.

On the other hand, in the third part of the questionnaire, we prepared 26 questions about operational effectiveness from the literature review and several items emerged from the interview process with users of EIS in the researched organisation. No previous study has tested operational effectiveness linked with technology innovation effectiveness. We argue that the effectiveness of a system cannot be measured without a real understanding of the operations of the organisation. It is essential to bring the dimensions of operational effectiveness into the IS context to enable a better understanding of the real effectiveness of the enterprise information system implementation.

Data were analysed and tested using principal components analysis and correlation analysis techniques. The emerging factors were named based on the previous knowledge of the literature. Next, Cronbach's alpha coefficients of the emergent factors were calculated and were used to assess convergent validity. The final stage was a confirmatory stage through structured interviews with managers, engineers and general staff from the organisations involved in the research. The main aim was to confirm the findings in the two previous stages. Thus this research involves both theory building and theory testing.

CASE ORGANISATIONS

Respondents were employed in two large organisations from the Australian service sector (electricity distribution and retailer sector and higher education sector) they were selected for the first stage of this study as they had recently implemented EIS. The first organisation is a government owned electricity distribution network, covering a sparse, predominately rural environment, with significant clusters of mining and industry through its million square kilometres of territory. Its primary challenges include rapid consumer and load growth; increasing environmental challenges, limited human and capital resources, and impending technological transformation in its core operations. The organisation has a turnover around $1,500,000,000, manages an asset base of $5.6 billion dollars and employs over 4,000 people. The organisation is using an ERP (enterprise resource planning) system that had been developed initially for use in the mining industry. The developers adapted the EIS application to work in the electricity distribution and retailer sector arguing similarities in the business processes.

The second organisation is a relatively new Australian university with extensive operations across Australia. It started as a College of Advanced Education, becoming a University in 1992. The university has a number of campuses in its regional footprint and in major Australian cities, the latter being operated by a wholly owned subsidiary servicing full-fee paying, international students. The organisation has a turnover around $278,000,000 with more than 1400 permanent staff. The organisation implemented an EIS, which was acquired with the main purpose of integrating the university's administrative systems and reengineering the administrative procedures and practices. Specifically, the ability for students to enrol themselves online and to manage their own personal details was seen as an essential strategic move for the university as existing paper-based enrolment and maintenance of student personal details were difficult to manage.

RESULTS

The results of interviews and analysis of some of the organisations' documents confirm the existence of the dimensions for systems effectiveness and operational performance, described in the background section of this paper. The respondents from the two organisations identified linkages between the quality of information and quality of the service stemming from the technology innovation effectiveness perspective, and the five performance objectives (cost, quality, flexibility speed and reliability) stemming from the operational effectiveness perspective. Those dimensions and operational performance objectives and also some of the conflicts with the quality of the service offered by the IS department, helped the researchers in the development of the questionnaire. The following sections explain the process to test the three propositions stated in this study.

Proposition One - Assessment of Data Validity

Before operational effectiveness and technology innovation effectiveness can be used together as a measure of the alignment in organisations after the implementation of EIS, it is necessary to assess its validity. The questionnaires were emailed to employees in managerial or executive role, information technology/information systems or engineering role and operators or general staff in the selected service organisations. Of the 450 surveys distributed among the service organisations from the electricity distribution and retailer sector and higher education sector, 144 were returned (32% response). Each returned questionnaire was reviewed for completeness and, of the 144, 6 were considered unusable due to large amounts of missing data, lack of involvement of the respondent in the use of EIS, and the impossibility of identifying the role of the respondent (manager, engineer or operator-user).

Table 1. Reliabilities (Cronbach alpha) and Pearson Correlation Matrix
(two-tailed test, significance in brackets)

	No. of Items	1.	2.	3.	4.	5.	6.	7.	8.
1. User Satisfaction	2								
2. System Quality	4	.184 (.030)							
3. Service Quality	8	.260 (.002)	.516 (.000)						
4. Information Quality	4	.226 (.008)	.688 (.000)	.559 (.000)					
5. OE Quality	9	.223 (.008)	.450 (.000)	.582 (.000)	.486 (.000)				
6. OE Cost	3	.101 (.238)	.510 (.000)	.577 (.000)	.439 (.000)	.641 (.000)			
7. OE Speed	6	.207 (.015)	.505 (.000)	.533 (.000)	.631 (.000)	.589 (.000)	.703 (.000)		
8. OE Flexibility	3	.158 (.065)	.559 (.000)	.596 (.000)	.570 (.000)	.765 (.000)	.707 (.000)	.651 (.000)	
9. OE Reliability	3	.087 (.309)	.508 (.000)	.553 (.000)	.572 (.000)	.652 (.000)	.646 (.000)	.682 (.000)	.755 (.000)

The second section of the questionnaire (technology innovation effectiveness), reported a Cronbach's Alpha coefficient of 0.859. This indicates a high level of internal consistency within these measures as the generally accepted lower limit is 0.7, though some studies allow 0.6; for example, Hair et al.[4]. The third section of the questionnaire (operational effectiveness), reported a Cronbach's Alpha coefficient of 0.936. This coefficient demonstrates the high internal consistency of the scale, and also support the argument to bring the dimensions of operational effectiveness into the IS context to have a better understanding of the real effectiveness of the enterprise information system implementation.

The strength and nature of relationships between the dimensions stemming from technology innovation effectiveness (User Satisfaction, System Quality, Service Quality, and Information Quality) and the performance objectives stemming from operational effectiveness (Quality, Cost, Speed, Flexibility and Reliability), highlighted areas in Table 1, were investigated using the Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of linearity and homoscedasticity and further tests for outliers and normality were conducted as required during the analysis. There are strong, positive and significant correlations between some variables, such as $r=.631$, $p<.001$ for Information Quality and Operational Effectiveness (OE) Speed, $r=.596$, $p<.001$ for Service Quality and OE Flexibility, $r=.577$, $p<.001$ for Service Quality and OE Cost, $r=.572$, $p<.001$ for Information Quality and OE Reliability; as shown in the highlighted area in Table 1. Support is therefore found for proposition 1 that there is a correlation between dimensions of technology innovation effectiveness and operational effectiveness. This high correlation and significance means, that the performance objectives stemming from operational effectiveness can be used to measure the impact of the implementation of technological innovations such as enterprise information systems on operational performance. In addition, the dimensions stemming from operational effectives produce a more comprehensive model than the traditional Systems Effectiveness Success model developed by DeLone and McLean [2].

Proposition Two –Factor Analysis

As the main purpose of the study is to explore the alignment between technology innovation effectiveness and operational effectiveness, the next step in the data analysis is to perform a factor analysis to reduce the dimensionality and to identify the most important clusters, while at the same time eliminating the items that are less explanatory. The factor analysis was performed using the maximum likelihood extraction method and oblique rotation method which allows the factors to be correlated. During the factor analysis process, four factors emerged. Hair et al [4] argue that in order to ensure a power level of 80 percent, a factor loading of 0.55 is significant if the sample size is at least 100 observations at a significant level (α) of 0.05. Thus, only factor loadings of at least 0.60 have been considered. The solution resulted in a Kaizer-Meyer-Olkin (KMO) value of 0.832 with four factors accounting for 52.65% of the cumulative variance, indicating a satisfactory solution. Table 2 contains the rotated factor matrix with their respective significant loadings and the variables that emerge in the factor analysis. Support is therefore found for proposition two that a limited number of factors have the potential to explain the alignment between technology innovation effectiveness and operational effectiveness. The four factors, are: quality and speed stemming from operational effectiveness and quality of information and quality of the service stemming from technology innovation effectiveness. These four factors also demonstrate the focus that the organisations need to consider when aligning technological innovations to enhance operational performance.

Table 2. Factor loading and Cronbach Alphas

Factor	Variable	Loading	Alpha if deleted
Factor-1 Operational Effectiveness (Quality)	The organisation is seeking for opportunities to bridge the gap between what the organisation is capable of offering and what customers demand	0.81	.933
	The organisation is looking for a consistent provision of products and services that satisfy customers	0.78	.933
	The quality of services provided by my business unit have improved with the help of information systems	0.74	.933
Factor-2 Operational Effectiveness (Speed)	My business unit is able to minimize the time needed to deliver our product/services	0.84	.932
	This organisation is able to deliver a product or service with the frequency and at the time that the customer requests	0.67	.932
	Our products/services are delivered on time	0.60	.933
	My business unit is able to shorten the time between the service or product request and service or product delivery	0.61	.933
Factor-3 System Effectiveness (Information Quality)	I can trust in the information from the information system application (EIS or ERP)	-0.74	.846
	The quality of the information that I get from the information systems applications (EIS or ERP) is high	-0.70	.840
	Managers can make decisions based on the information from the information system	-0.69	.849
	Key data is presented to different levels of the organisation in a way that enhances understanding of the issues	-0.60	.845
Factor-4 System Effectiveness (Service Quality)	The training provided by the information systems department is appropriate according to the user's needs	0.69	.849
	The lack of importance given to information systems is reflected in the lack of training of users in this organisation	0.67	.849
	There is a high level of conflict with the information systems department	0.62	.851

Proposition Three –Multiple regression analysis

Stepwise -forward- multiple regression was used to assess the ability of the factors emerging from system effectiveness (Information Quality, Service Quality) and operational effectiveness (Quality and Speed) to predict improved operational performance. According to Ho [7] the statistical regression model is used primarily in exploratory work, in which the researcher is unsure about the relative predictive power of the study's independent variable.

Table 3 represents entry of the set of predictors of improved operational performance (IOP). The results show that Factor 1 'Operational Effectiveness Quality' accounted for 57.1% of the variance (R square) in the improvement of operational performance (IOP). Likewise, Table 3 shows that Factor 3 'System Effectiveness Information Quality' accounted for 15.2% of the variance (R square). Entry level of the independent variable Factor 2 'Operational Effectiveness Speed', resulted in a significant F change, $F(1,134)= 6.11$, $p<0.05$ for improved operational performance, and increased variance explained by 1.2% (R Square Change) to 73.5%. Factor 4 'System Effectiveness Service Quality' has been deleted as the variance accounted (R square) less than 1.2% and a significance p > .05, and is not seen as a predictor of improved operational performance.

Table 3. Predictors of improved operational performance (IOP)

Dependent Variable	Predictors	R	R Square	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
Improved Operational Performance -IOP-	Factor-1 Operational Effectiveness Quality	0.756	0.571	0.571	180.985	1	136	0.000
	Factor-3 System Effectiveness Inform. Quality	0.850	0.723	0.152	74.166	1	135	0.000
	Factor-2 Operational Effectiveness Speed	0.857	0.735	0.012	6.107	1	134	0.015

Table 4.ANOVA for improved operational performance (IOP)

Dependent variable	Predictors		Sum of Squares	df	Mean Square	F	Sig.
Improved Operational Performance	Factor-1 Operational Effectiveness Quality	Regression	99.569	1	99.569	180.985	0.000
		Residual	74.820	136	0.550		
		Total	174.389	137			
	Factor-3 System Effectiveness Inform. Quality	Regression	126.098	2	63.049	176.259	0.000
		Residual	48.290	135	0.358		
		Total	174.389	137			
	Factor-2 Operational Effectiveness Speed	Regression	128.203	3	42.734	123.986	0.000
		Residual	46.186	134	0.345		
		Total	174.389	137			

In Table 4, the results show that the predictors or independent variables generated a significant prediction equation. $F(1,136) = 180.99$, $p<0.01$for Factor 1 Operational Effectiveness Quality, $F(2,135) = 176.26$, $p<0.01$ for Factor 3 System Effectiveness Information Quality, $F(3, 134) = 123.99$, $p<0.00$, for Factor 2 Operational Effectiveness Speed.

Table 5.Coefficient table for improved operational performance (IOP)

Dependent Variable	Predictors	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
Improved Operational Performance	(Constant)	1.926	0.221		8.707	0
	Factor-1	0.581	0.045	0.747	12.807	0
	(Constant)	0.678	0.228		2.968	0.004
	Factor-1	0.49	0.038	0.629	12.961	0
	Factor-3	0.368	0.043	0.419	8.632	0
	(Constant)	0.5	0.243		2.058	0.042
	Factor-1	0.477	0.038	0.613	12.593	0
	Factor-3	0.324	0.048	0.369	6.798	0
	Factor-2	0.099	0.049	0.108	1.997	0.048

Looking at the Coefficients table (Table 5), the Beta weights (standardized regression coefficients) for the three factors, Factor 1 'Operational Effectiveness Quality', has the strongest unique contribution to the prediction of Improved Operational Performance, whereas Factor 3 'System Effectiveness Information Quality' and Factor 2 'Operational Effectiveness Speed' are weaker. Furthermore, the positive coefficients indicate that the greater the focus on quality of the operational services, quality of information and quality of the operational speed, the more that organisation will see improvements in the operational performance (Factor 1: Beta = 0.61, t = 12.59, $p<0.05$, Factor 3: Beta = 0.37, t = 6.80, $p<0.05$, Factor 2: Beta = 0.11, t = 2.00, $p<0.05$). The three independent variables are also making a significant contribution to the prediction of the dependent variable: Improved Operational Performance, where $p < 0.001$ for the three independent variables. Support is therefore found for proposition three that the emerging factors: Factor 1 'Operational Effectiveness Quality', Factor 3 'System Effectiveness Information Quality' and Factor 2 'Operational Effectiveness Speed', explain the interrelatedness between system effectiveness, operational effectiveness and improved operational performance. Furthermore, evidence indicates that quality in the operations is the best predictor of improvement in operational performance.

CONCLUSION

In answering the research question 'Which factors are the best predictors of improvement in operational performance when technological innovations are adopted?' this research has found three factors that explain the interrelatedness between system effectiveness, operational effectiveness and improved operational performance. Moreover, evidence indicates that quality in the operations is the best predictor of improvement in operational performance. Additionally, it is important to note that decisions about innovation are made based on information, so organisations need high quality information. One of the problems in continuously innovating organisations is that although they implement EIS systems these do not lead to improved operational effectiveness. The organisations in the first stage, are becoming more complex and more dynamic and they are seeking to innovate to deliver high quality services, cheaper and faster. However, the extent to which this innovation helps the organisations in the delivery of better services and in reducing operational cost is questioned by this study.

The interviews and analysis of the organisation's documents reveals that stakeholders are aware of the performance objectives defined in this study. In addition, the quantitative stage has demonstrated that the linkages between technology innovation effectiveness (information system effectiveness) dimensions and operational effectiveness performance objectives are important and significantly well correlated. The high positive correlations of technology innovation effectiveness with operational effectiveness dimensions provide strong empirical support to include the stated operational effectiveness dimensions or performance objectives in the measurement of EIS success. Previous studies have tested the different dimensions in information systems context; however, they did not consider the performance objectives from operational effectiveness viewpoint such as quality, cost, speed, flexibility and reliability. The high Cronbach Alpha coefficient of 0.936 supports the importance of bringing the dimensions or performance objectives of operational effectiveness in to the technological innovations effectiveness context. Furthermore, these new dimensions will assist organisations to measure, in a more accurate way, the impact of the EIS implementation on the business processes and operations of the organisation. At the same time, these additional dimensions will promote the alignment between technology innovation effectiveness and operational effectiveness in the implementation of enterprise information systems, as focusing on either technology innovation effectiveness or operational effectiveness alone is detrimental to the long term performance of the enterprise and will lead to a failure to achieve the real value of technological innovations.

MANAGERIAL IMPLICATIONS

By shedding some light on the complex phenomena that link technology innovation effectiveness, operational effectiveness and improvements in the performance of organisations, this work provides useful insights both to managers and academics in the implementation of technological innovations such as enterprise information systems.

The challenge for managers is to develop and adopt a prevailing set of goals and set of operating rules and procedures for the enhancement of the overall quality across the organisations, in an effort to promote higher levels of improvement in the performance of operations. Nevertheless, achieving higher levels of quality appears to be more complicated than previously thought as employees at different levels must have a real commitment to achieving quality in all aspects of their day to day operations. This suggests that the organisations must work on all dimensions to maximize the probability of achieving success and avoid the conflicts among different technological frames. In addition, the challenge for these organisations is to improve the quality of the information, the quality of the services and the speed to deliver high quality services as the research has revealed the importance of these three dimensions or performance objectives in the improvement of operational performance. This research also has shown quality, in the operational activities, is the best predictor of improvement in operational performance.

This research has demonstrated that the relationship between operational effectiveness and technology innovation effectiveness is important, because an optimal alignment has a positive influence overall performance. The main concern for organisations is to reduce and control increasing cost and allocating resources. However, the identification of appropriate systems dimensions and performance objectives becomes essential for continuous improvement. Competition is constantly increasing so corporate strategies should support this alignment. Furthermore, managers need to understand their operations, and adapt the systems to the operational requirements. Also, causes of user dissatisfaction should be identified, information outcomes should be properly assessed and finally, the performance of operations and systems should be evaluated, because if organisations do not pay attention to these issues, they are more likely to continue allocating resources to EIS that do not make business sense. The solution is based on enhancing the effectiveness and efficiency of operational and system processes with an aligned approach so technology innovation such as EIS that can deliver the expected outcomes and help organisations to improve their performance.

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