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Enterprise Resource Planning (ERP) Innovation Process: Towards Development of an Integrated Framework for Successful Adoption and Implementation

Jiwat Ram
School of Computer and Information Science University of South Australia, jiwat.ram@unisa.edu.au

Paula M.C Swatman
University of South Australia, Adelaide, paula.swatman@unisa.edu.au

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Jiwat Ram
School of Computer and Information Science
University of South Australia
Email: jiwat.ram@unisa.edu.au

Paula M.C. Swatman
School of Computer and Information Science
University of South Australia
Email: paula.swatman@unisa.edu.au

Abstract

Enterprise Resource Planning (ERP) systems have attracted wide popularity as they promise multidimensional benefits and competitive leadership. However complexity and failures of their successful adoption and implementation have stolen the limelight, resulting in considerable literature on understanding the critical success factors (CSFs) or conditions in which the ERP systems could be successfully adopted and implemented. Grounded in innovation diffusion & IS Success theories, this empirical study aims to provide a roadmap for holistic examination of the conditions for successful adoption and implementation of ERP systems and their performance impacts in financial and non-financial terms. Employing a cross-sectional survey for data collection and Structural Equation Modelling for analysis, the study will test a research model comprising CSFs for ERP adoption and implementation processes and their link to performance impacts. Unique in the Australian context, the study will provide a theoretical framework to help organisations enhance their chances of successful ERP projects.

Keywords

Diffusion of Innovation, Adoption and Implementation, Enterprise Resource Planning, Performance, IS Success

INTRODUCTION

The notion that innovation enables value creation and is the source of competitive advantage has evolved from 'concept to cliché' (Johnston and Vitale 1988). Unprecedented innovation activities – both in the form of exploratory and exploitative innovations – combined with the increasing fusion of conventional and electronic modes of business have changed the character, intensity and dynamics of competition in the marketplace (Jansen et al. 2006). Firms are under constant pressure from market forces to perform and grow, with many facing a step-up or step-out business scenario. This 'market impatience' has brought about a fundamental shift in the way firms do business; leading to profound structural, economic, social, and technological changes in today's marketplace. Organisational innovation is thus perceived as a means of effectiveness and of survival (Damanpour and Schneider 2006).

Investments in information and communications technology and system (ICT/IS) innovations, their economic payoffs, and their impact on organisational performance have been widely discussed and empirically investigated in a variety of information systems (IS) and management journals, yielding conflicting results (Santhanam and Hartono 2003). The stakes rise higher when organisations undertake adoption and implementation of complex enterprise-wide technologies such as Enterprise Resource Planning (ERP) systems, as these are costly and have a somewhat mixed history of success (Mabert et al. 2003) and failure which can lead implementing companies into financial difficulties (Liang et al. 2007).

Although investment in ERP continues to increase, the adoption and implementation process of these systems is marred by a host of difficulties and failures. The high failure rates and implementation difficulties of ERP systems have resulted in huge monetary and resource losses and, occasionally, even in firms going bankrupt (Ehie and Madsen 2005). Successful investment in ERP requires a sound understanding of the adoption and implementation processes of these enterprise-wide systems (Laukkanen et al. 2007). ERP failures are the result of multiple causes and could be due to difficulties at a variety of stages of the ERP project lifecycle, including

the pre, during and post-implementation phases of the project. In this context, the following three issues are significantly important.

a) The identification of Critical Success Factors (CSFs) is an established approach in the ICT/IS literature, because CSFs can help organizations study their conditions in pre-adoption and implementation environments and "determine the corresponding solutions" to reduce or avoid the potential causes of failure, thus improving their chance of a successful ERP project (Ngai et al. 2008). The CSF approach is widely discussed in the ERP literature and while a significant amount of research into the effectiveness of CSFs for ERP has been undertaken, there have also been calls for more structured and comprehensive research (Finney and Corbett 2007). Additionally, the ERP implementation literature is not cumulative and is characterised by contradictory and frequently non-generalisable research findings (Law and Ngai 2007). This state of affairs can be attributed to the enterprise-wide character of ERP, to the interplay of organisational, technological, environmental, cultural and geographical factors or research setting dimensions.

b) Though the importance of CSFs is recognized, little is known about the relationship between CSFs and their impact on performance of the firms studied. An investigation of this relationship is vital in understanding the long-term impact of CSFs – as the literature makes plain (Nicolaou 2004).

c) Little research has been done into the adoption stage of ERP generally – and into the CSFs relevant to the adoption stage within the ERP context in particular. The adoption stage is the decision stage in an innovation process (Rogers 2003, p.420); and is important as the ERP adoption decision entails huge monetary and resource commitments. An incorrect adoption decision could 'well jeopardize the very existence of the organization' (Verville et al. 2005).

Furthermore, the literature suggests that the factors presented by classical innovation theory are unlikely to be strong predictors of the success of the innovation process, especially in the context of complex ICT/IS innovations, indicating that factors more specific to technology should be tested and added to the 'conventional' factor analysis research .

Therefore, the present research project aims to fill this gap in the literature and address the issues relevant to adoption and implementation of ERP in the Australian context by:

- investigating and identifying the antecedents critical to successful adoption and implementation of ERP
- measuring the performance impact of ERP
- examining the relationship between critical success factors (CSFs) for adoption and implementation of ERP and their performance impacts
- developing and proposing an integrated framework for successful adoption and implementation of ERP.

This study aims to contribute to the existing body of knowledge on ERP in a variety of ways by:

a) taking a process-oriented approach to provide a comprehensive understanding of the ERP innovation process by identifying the CSFs to two key stages i.e. adoption and implementation of the process. This would help firms to study their conditions against a set of identified CSFs, thus either completely eliminating the risk of failure or improving the chance of success of their ERP projects (Ngai et al. 2008)

b) testing some new factors / attributes, this study will attempt to improve the predictive power of innovation theories in an organizational context

c) enhancing our understanding of the relationship between CSFs and firm performance, thus fulfilling the calls in the literature to investigate whether the significance of CSFs is limited to specific innovation stages or can also affect firm performance

d) providing useful insights into the innovation process of ERP within the Australian context. Faced with large market distances for business operations, the successful ERP implementation can help Australian firms synchronize their operations with their business partners, provide timely information, make sound decisions; and respond and communicate effectively

e) from an industry perspective, the findings will serve to transfer knowledge to ERP vendors who will better understand the needs of potential ERP adopters, thus assisting vendors in their market activities

f) proposing an integrated model for successful adoption and implementation of ERP which could serve as decision making 'framework of reference' for stakeholders in formulating strategies for ERP projects .

LITERATURE REVIEW

1. ERP: significance and implementation problems

Enterprise Resource Planning (ERP) – a term coined by the Gartner Group in the early 1990's – is an enterprise-wide commercial software system based on best business practice. It is modular in structure, as each module automates the processes within a certain function of a business; and enables process and information integration across all functional domains of an organization. It is defined as the customisable commercial software system, embedding best business practices, built on a modular structure which automate and integrate the key business & management process and information using a common database, providing real time seamless integration of the information flow (Mabert et al. 2003).

ERP brings standardization across a variety of organizational functions, facilitating better communication among departments. The ERP suite supports critical business processes in many business operation areas (Cotteleer and Bendoly 2006). SAP, Oracle, Baan and PeopleSoft are some of the best-known ERP systems – although there is a continual process of mergers and acquisitions among ERP vendors.

Organisations investing in ERP endeavour to accomplish a number of objectives. Firstly, they want to benefit from ERP's cross-functional integration and embedded best-practice capabilities (Robey 2002), modular structure; and its flexible and scalable architecture. As Shang and Seddon (2000) point out, they then seek to achieve a variety of benefits – operational: reduced operating costs, accurate demand forecasts; managerial: improved decision making and better resource management; strategic: greater support for business alliances, building business innovations and cost leadership; IT infrastructure: building business flexibility; reducing ICT costs; and organizational benefits: supporting organizational change, facilitating business learning and empowerment (Basoglu et al. 2007). Lastly, to replace fragmented/multiple, difficult, costly to use and costly to maintain existing legacy systems – a situation known as "a maintenance nightmare" (Robey 2002). Ironically, this transition is neither easy nor agile.

Citing a Standish Group report on ERP implementation, Basoglu et al. (2007) noted that ERP projects are, on average, 178% over budget, take 2.5 times longer than intended to implement; and deliver only 30% of the promised benefits. Three quarters of the ERP projects studied were reported to be unsuccessful (Basoglu et al. 2007). In the same vein, several implementation sagas involving multinational firms, including Boeing, Siemens, Panasonic, AeroGroup, Dell, FoxMeyer, Whirlpool, and Dow Chemical have been reported in the literature. These corporations have either failed to implement their ERP projects as intended, or have abandoned the attempt to implement ERP altogether (Robey 2002). By contrast, several ERP implementation success stories have also been reported, suggesting that ERP implementation resulted in a reduction of shipment time for replacement parts from 22 days to 3 days at IBM Storage Systems; and that delivery performance improved from 60% to 95% with a lead time to customers reducing from 6 to 2 days at Par Industries (Ehie and Madsen 2005).

This discussion signifies the potential vs. risk of an ERP implementation project. Indeed, ERP implementation alone can make or break an organisation's competitive ability; and thus the successful adoption and implementation of ERP is vital in translating its potential benefits into the desired performance impacts. Next, we will review the literature on ERP adoption and implementation in Section 2 and the performance impacts of ERP in Section 3.

2. Review of studies on Adoption and Implementation of ERP

The literature review suggests that though a significant number of studies have considered the CSFs for ERP implementation and, to a very limited extent, the CSFs for ERP adoption, our understating of CSFs at both the adoption and implementation stages and the ways in which they relate to organisational performance impacts still remains very limited.

In order to assess the importance of various factors on ERP implementation success and their relationship to performance, Bradford and Florin (2003) using Diffusion of Innovation and IS Success theories conducted an empirical study and proposed a model of ERP implementation success. These authors concluded that, while top management support and training positively affect user satisfaction; competitive pressure and complexity of ERP negatively affect user satisfaction. They also found that degree of consensus in organisational objectives and competitive pressure was directly and positively associated with organisational performance impacts.

These findings were supported by those of Liang et al. (2007), who surveyed 77 Chinese organisations and discovered a positive relationship between top management mediation and the influences of institutional forces on the degree of use of ERP. Interestingly, however, Law and Ngai (2007) found that senior management support was not critical to user satisfaction. These authors also showed that user satisfaction combined with

business process improvement (BPI) positively affected the organisational performance of ERP-adopting organisations.

Somers and Nelson (2004) focussed on the project life cycle of ERP, using a six-stage model of ERP implementation (initiation, adoption, adaptation, acceptance, routinization and infusion). They found that the role of the steering committee was critical through the first fives stages of implementation. Among the critical factors they found that top management support, user training, business process re-engineering (BPR), vendor support; and consultant support had a significant influence at various stages of pre to post-implementation of ERP.

Ehie and Madsen's (2005) empirical study found project management principles, feasibility/evaluation, business process reengineering, top management support, cost/budget analysis and consulting services as critical to the successful ERP implementation. Hong and Kim (2002) tested the concept of 'ERP fit' and found it was, indeed, critical to the success of an implementation.

3. Review of studies on Performance Impacts of ERP

The performance impacts of ICT systems have been widely discussed using a variety of theories, methodologies, approaches and attributes. A review of the relevant literature suggests that a number of studies have considered pre vs. post implementation data to analyse the impact of ERP implementations in terms of both tangible and intangible measures.

Among the various key issues discussed in the literature, the assessment of the performance impacts of ERP from financial perspectives was one of the first. Poston and Grabski's (2001) longitudinal study of pre vs. post implementation provided mixed results. It found no significant improvements, either in residual income or in decreased selling, general and administrative revenue expenses, in the 1st and 2nd years of ERP implementation. However, the study revealed a significant decrease in the ratio of employees to revenue in all 3 years, plus a significant improvement in the ratio of cost of goods sold to revenue in the 3rd post-implementation year. Hunton et al. (2003) suggested a different approach, arguing that a decline in financial performance of non-adopters relative to adopters should be anticipated and studied, as adopting firms may not necessarily exhibit financial gains immediately for a number of reasons. These authors' study of 63 ERP-adopting firms against matched pairs of non-adopting firms lent support to their argument.

Among the studies measuring the non-financial impacts of ERP, O'Leary (2004), using data from companies which had opted for Oracle's ERP, identified several tangible and intangible benefits of ERP implementation.

Considering ERP's multi-directional impact, McAfee (2002) observed significant operational performance improvements in the pre vs. post ERP implementation contexts. Supporting these findings, Cotteleer and Bendoly (2006) discovered significant performance improvements in order fulfilment lead times in the near-term, as well as over an extended period following the deployment of an ERP system.

Interestingly, the time lag has been seen as quite important in assessing ERP performance outcomes. Although the 'normal' time lag has been found to be approximately 3 or more years, Matolcsy et al. (2005) reported sustained operational efficiencies and overall improved liquidity for adopting firms after the second year of implementation. Similarly, Nicolaou's (2004) study supported this view of early impacts on performance and found that ERP implementing firm realised performance impacts (ROI improvements) in their 2nd year after implementation.

Urging further empirical studies that consider implementation factors and their linkage to performance impacts, Nicolaou (2004) concluded that implementation factors such as vendor selection, implementation goals, scope and time on ERP implementation efforts are significant in affecting a firm's realisation of performance impacts.

THEORETICAL BACKGROUND

1. Diffusion of Innovation

Rogers (2003) Diffusion of Innovation (DOI) theory provides two sets of innovation models: individual and organisational. The organisation innovation process (Rogers 2003 p.420) is a sequential combination of five stages, made up of a two-stage initiation sub-process (which is composed of agenda-setting and matching); and a three-stage implementation sub-process (composed of redefining/restructuring, clarifying and routinising). Rogers (2003 p.411-12) suggested that organisational innovativeness – *the degree to which an adopting unit is earlier in adopting new ideas than the other members of a system* – is dependent on factors such as individual (Charismatic leadership, internal e.g. centralization, complexity, formalization and external characteristics e.g. system openness etc. Rogers (2003) takes a formulaic approach to the adoption and diffusion of innovations,

categorising: types of adopters and their characteristics; perceived characteristics of the innovation; stages of the innovation decision-making process; and stages of the innovation process within organisations.

While Rogers' (2003) innovation model has been tested in cross-disciplinary contexts and many researchers have presented updates, extensions and revision to this model, it can be argued that most of these models explain the adoption and implementation phenomenon in similar contexts through a sequence of stages using different terminologies. The literature review also suggests that the innovation process is a combination of three sub-processes i.e. generation, diffusion and adoption of innovation. Many later researchers have criticised Rogers' model as being too formulaic and lacking in realism, with Evolutionary Diffusion Theory (Lambooy and Boschma, 2001; Lissoni and Metcalfe 1994) being seen by many as providing more effective explanations for organisational behaviour. Models based on Evolutionary Diffusion Theory stress the *gradualism* of internal adoption between firms and over time: '*Firms called 'adopters' at a given time actually differ in the extent of their commitment to the new technology ... some of them may subsequently reverse their adoption decision*' (Lissoni and Metcalfe 1994, p.108).

Given the focus of this study, however, we employ Rogers (2003) stage-based organisational innovation model to examine the ERP adoption and implementation process. Evolutionary Diffusion Theory does not lend itself well to a quantitative exploration of multi-firm activity.

2. IS Implementation Model

Kwon and Zmud (1987, p.233) proposed a multi-stage model of IS implementation, theorizing that organisational innovation follows six stages, including: initiation, adoption, adaptation (development/installation), acceptance, use and incorporation. The model provides an extension to Rogers (2003, p. 392) five-stage organisational model, with one exception, believing that four assessments (acceptance, usage, performance and satisfaction) should be incorporated into the innovation process model, as these form the basis for implementation success. Since Kwon and Zmud's (1987) IS implementation model has been widely tested and has proved robust in explaining the adoption and implementation process of information systems within an organisation, we make use of this model for our study.

3. IS Success Model

Delone and McLean (1992), in their now famous IS success model, posited that system quality and information quality jointly and severally affect use and user satisfaction which, in turn, result in individual impact and subsequent organisational impacts. Further research into this model, however, led to the addition of dimensions such as service quality, intention to use and Net benefits (replacing organisation impact construct) (Delone and McLean 2004).

RESEARCH HYPOTHESES AND MODEL

Kwon and Zmud (1987) argue that five broad categories of factors impact positively on the successful outcome of IS implementation: individual, structural (organisational), technological, task-related; and environmental factors. These authors' position is consistent with Rogers' (2003) attributes of innovation. Based on a review of factors presented in these theories and the literature, and using a theoretical synthesis of these three models, we adopt the following factors and examine their impact on the ERP innovation process. The model is then shown graphically in Figure 1.

1) Information quality

Information quality refers to measures of IS output, and has been measured in a variety of ways, e.g.: accuracy, output precision, output reliability, information timeliness, information relevance to decisions, completeness, format, understand-ability etc. (Delone and McLean 2004; Nelson and Todd 2005). Information quality has been found to relate positively to user satisfaction (Nelson and Todd 2005), so that ERP information quality would appear to be critical to adoption success of the system. Further, ERP systems are generally recognised as providing reliable, accurate and timely information. We argue that ERP information quality is a positive contributing factor to adoption success, and develop the following hypothesis:

H1: ERP's ability to provide information quality will be positively related to the adoption.

2) System quality

DeLone and McLean (2004) found system quality to be one of the most important enablers of IS success, in their meta-analysis of the IS literature. Systems quality has been measured in a variety of ways, e.g. convenience of access, integration capabilities, reliability, ease of learning, resource utilisation, investment utilisation, flexibility

of system, response time and usefulness of specific function etc. (Delone and McLean 2004; Nelson and Todd 2005). It has been seen as an important factor for ERP implementation and was positively associated with user satisfaction (Nelson and Todd 2005). ERP systems are believed to provide integration, flexibility, and optimum resource utilisation – and thus provide high system quality. We argue that ERP's system quality capabilities will be an important factor for adoption success and thus develop the following hypothesis:

H2: ERP's ability to provide system quality will be positively related to the adoption.

3) Organisational Readiness

Organisational readiness has been defined as "the ability of a firm to successfully adopt, use, and benefit from information technologies" (Fathian et al. 2008). Prior studies have used a variety of measures to investigate readiness, e.g. awareness of benefits and risks of innovation; availability of human resources skills and capabilities; availability of technological, business and financial resources, commitment and support by top management, fit between innovation and organisational structure as well goals and values of organisation (Fathian et al. 2008; Molla and Licker 2005). Grounded in structural contingency theory of fit, Khazanchi (2005) believes that assessment of 'readiness' for an organisation to adopt a certain technology is an important criterion for successful implementation and performance impact. Researchers often posit that top management attitudes to change have significant influence on adoption outcomes (Wu et al. 2003). Organisational readiness positively impacts adoption of technological innovations (Molla and Licker 2005). An ERP adoption introduces enterprise-wide change. Hence it is expected that the internal organisational preparedness will be critical to adoption success and therefore we hypothesise:

H3: Organisational readiness will be positively related to the adoption.

4) Environmental Assessment

Chi et al. (2005) note that: "an environmental assessment evaluates external information and identifies business needs, objectives, external opportunities, and threats". Though environmental assessment has been measured using many indicators, it broadly encompasses: hostility, dynamics and heterogeneity of environment (Newkirk and Lederer 2006). These authors note that environmental hostility includes unpredictability of competitors' market activities; legal, political or economic constraints; Price / Product quality competition; labour scarcity; and Product / service differentiation. By contrast, they argue that, environmental heterogeneity includes diversity in production and marketing methods; in customer buying behaviours; in the nature of competition; and in product line. Finally, growth opportunities, change in production/service technologies, rate of innovation, product / technology changes etc. indicate environmental dynamics. Competitive pressure, normative pressure and customer power have been found to positively impact adoption of technologies (Wu et al. 2003).

A dynamic, heterogeneous and hostile business environment may affect stability of demand, put strains on supply, generate a disloyal customer base; and result in fluctuating economic outcomes. Thus, a system that predicts, coordinates and forecasts market trends will enable the organisation to react swiftly and efficiently to market changes (Wu et al. 2003). ERP systems, with their flexible and integrative architecture, seamless data flow and real-time global connectivity features have the capacity to help forecast demands and supply variations, support sound decision-making, efficient utilisation of resources and achieve competitive advantage. We therefore postulate:

H4: An Environmental assessment characterised by environmental hostility, dynamisms and heterogeneity will positively influence adoption.

5) Organisational Compatibility

Organisational compatibility refers to organisational 'fit' of an innovation, as well as to its impact on an individual's attitudes, beliefs, and experiences towards innovation (Kwon and Zmud 1987; Rogers 2003). It is defined as "the degree to which an innovation is perceived as being consistent with the existing values, needs and past experience of potential adopters" (Rogers 2003, p.15). Considerable prior literature has studied compatibility from task-technology and technology-organisation contexts using terms such as 'fit', 'appropriateness' (see for review, Khazanchi 2005). A high degree of innovation compatibility to organisational values, beliefs, culture, existing IT/IS infrastructure and past innovation adoption experiences would facilitate greater acceptability within organisation system. A number of studies have found a positive association between organisational compatibility and innovation adoption (Lee and Kozar 2008). Ngai et al. (2008) note the importance of compatibility in the ERP context, and argue that an ERP package with higher compatibility and lower fit-gap with the needs and culture of the organisation is critical to ERP project success. Since ERP is a disruptive technological innovation, introducing wide scale changes into an organisation, an assessment of its compatibility will substantially improve its chances of adoption success. Hence:

H5: Organisational compatibility of ERP will be positively related to the adoption.

6) Perceived Strategic Value (PSV)

Information systems form the key strategic assets of an organisation's asset portfolio. Thus their adoption is motivated by "business justification and strategic value" which the new systems are seen as bringing to the firm (Subramanian and Nosek 1993). Subramanian and Nosek (1993) pioneered the concept of perceived strategic value and presented three factors: operational support, managerial productivity and strategic decision aid, to measure perceived strategic value. Amit and Zott (2001) found four key factors of strategic value in e-business context: transaction efficiency, complementarities, lock-in and novelty. Grandon and Pearson (2004) concluded a positive relationship between PSV and adoption. ERP involves a huge monetary and resource commitment and promises benefits in operational, managerial and organisational domains. It is considered a tool for achieving operational efficiency and competitive advantage, thus we argue that a positive assessment of ERP's perceived strategic value would contribute to successful adoption of ERP. Thus we develop the following hypothesis:

H6: Higher Perceived Strategic Value of ERP will be positively related to the adoption.

7) Project Management

The complexity of ERP projects involving a variety of IT and organisational issues necessitates careful planning, coordination, budgeting, scheduling and monitoring of the project; and use of project management techniques can provide vital ingredients for achieving successful implementation (Ngai et al. 2008). Researchers argue that project management will help to define the objectives of the project, the scope of the ERP project including modules selected for implementation, the amount of time needed for implementation, the level of involvement of business units, the needs of BPR; and the ability to chalk out time schedules and monitor progress (Ehie and Madsen 2005). It is found to be important CSF for successful ERP implementation (Ehie and Madsen 2005; Ngai et al. 2008). Considering the variety of reasons for ERP project failure discussed earlier in this paper, we argue that the use of project management techniques will be vital to successful implementation of ERP, and hence we hypothesise that:

H7: Use of Project management will be positively related to the implementation.

8) Business Process Engineering (BPR) / Improvement (BPI)

ERP applications embed best business practices but may not be compatible with existing business processes and practices, requiring organisations to improve or reengineer their business processes to bring them into line with ERP's business models (Lee et al. 2003; Bingi et al. 1999). BPR/BPI may be costly if the ERP rollout encompasses worldwide operations; and complex if certain processes are considered unique to the business and must be preserved (Bingi et al. 1999). Customisation of ERP entails significant cost, time and resources, and organisations must thus find the right balance between these two alternatives. BPR was seen as a critical factor in the early stages of the ERP implementation process (Ehie and Madsen 2005; Ngai et al. 2008). Lee et al. (2003), citing Foster research data, argued that organisations prefer to implement ERP with few modifications. Thus we postulate:

H8: Undertaking BPR / BPI will be positively related to the implementation.

9) System Integration

Lee et al. (2003) define the term system integration as "the capability to integrate a variety of different system functionalities." Ideally, organisations view ERP as a single solution covering all business functions. However it is not uncommon to find that firms prefer to retain some existing specialised software packages (Bingi et al. 1999), necessitating the integration of ERP with these applications. This is, however, a complex process, especially given ERP's integrative modular structure (Ngai et al. 2008). Middleware facilitates this integration (Lee et al. 2003), but Bingi et al. (1999) observe that middleware vendors concentrate mostly on popular ERP packages; and often focus on technical aspects of application interoperability, rather than linking business processes. In addition, cost to implement and maintain the integrated connectivity can absorb a considerable amount of the ICT budget (Bingi et al. 1999). Therefore we postulate that:

H9: System integration of ERP with other organisational applications will be positively related to the implementation.

10) Training & Education

User training and education is an important implementation factor, and has been found to be responsible for a number of ERP implementation problems and system failures (Somers and Nelson 2004). This is a continuous process of transfer of both tacit and explicit knowledge of the overall logic, concept and working of the system; and equipping users with understanding of business processes embedded in ERP application. A number of studies have found training & education critical to implementation success of ERP and change management

programs (Ngai et al. 2008; Somers and Nelson 2004). Based on these arguments, the following hypothesis is proposed:,

H10: Training & education will be positively related to the implementation.

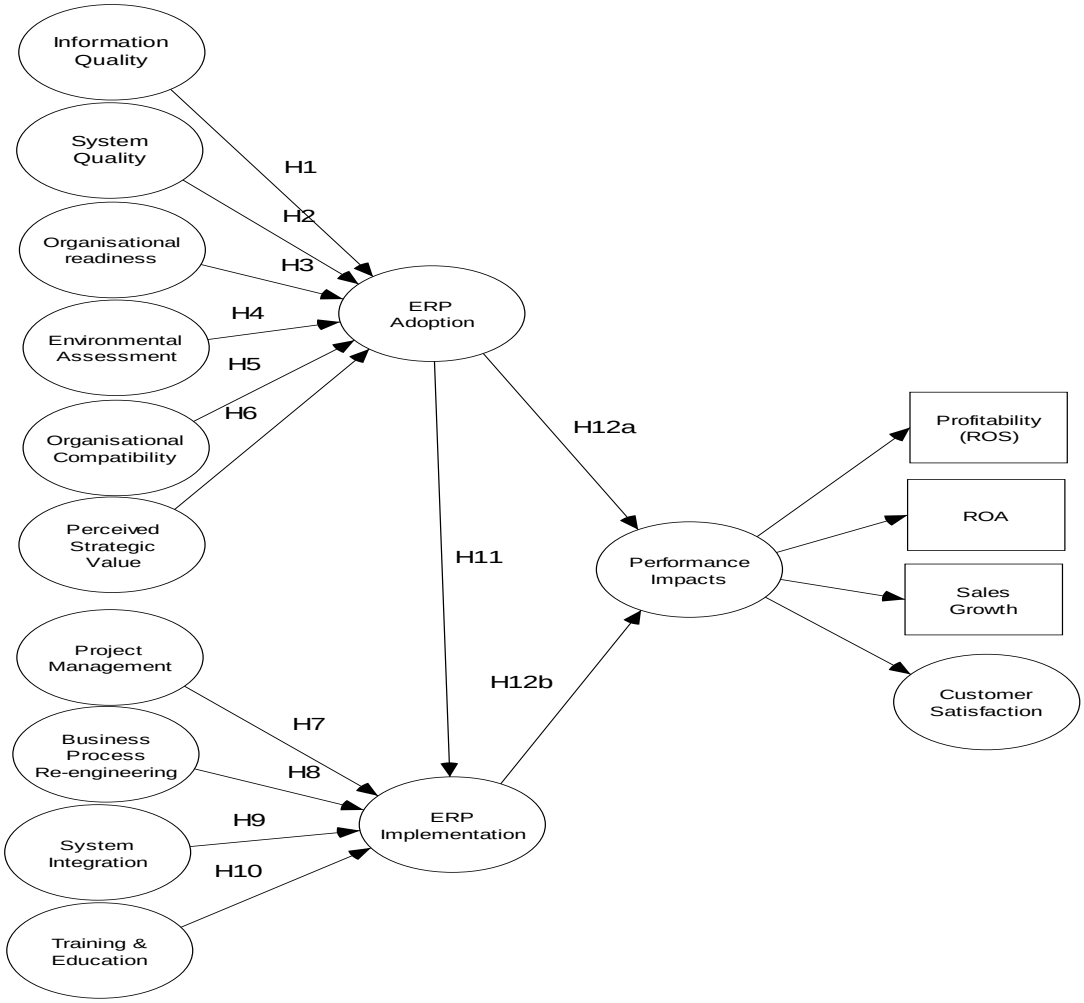

Figure 1: Preliminary Research Model

RESEARCH METHODOLOGY

The proposed research study will empirically test the conceptual model presented in Figure 1 and the associated hypotheses, drawn from the synthesis of three theoretical frameworks presented under theoretical foundation in this paper. The study uses a quantitative approach to identify the influence of various organisational, technological, environmental and ERP implementation-related variables on performance outcomes. The choice of quantitative approach suits the objectives of this study, as it not only allows measuring a large number of variables from an expected large sample of respondent organisation, but also provides an opportunity to analyse the collected data using a robust statistical tool. Considering that the conceptual model of this study is: grounded in theory, takes a confirmatory approach to test the various hypothesised relationships a priori and includes relationship between multiple latent and measured variables, we felt it most appropriate to use Structural Equation Modelling (SEM) for the data analysis.

The data will be collected through a cross-sectional survey, providing greater external validity and generalisability of results. The respondents will be Australian organisations, which have successfully implemented ERP. The respondent organisations will be identified using “Fairfax Business Research's MarketBase” companies’ database which includes decision-maker & company contact information, ERP software details and financial data of the company. Consistent with prior research into ICT innovations and given the focus of this study, the target respondent group will be senior IS managers (e.g. Chief Executive, Technology and Information Officers and business managers with dedicated involvement in the adoption and

implementation of ERP in their respective organisations), as senior managers/ executives fit the criteria of: (a) knowledge ability concerning the content of the enquiry; and (b) ability to generalise patterns of behaviour after summarising either observed or expected organisation relations (see Wu et al. 2003).

All latent variables shown in the model (See Fig. 1 above) will be measured through multiple item scales, which are expected to provide stronger construct validity. The various objective performance variables considered in the framework will be measured using financial data of the respondent organisations using the "Fairfax Business Research's MarketBase" companies' database Wherever possible, measurement items which have been operationalised and tested in previous empirical studies will be re-used, which will increase the comparability and reliability of the results. Except for the objective financial performance items, all other items will be measured using a five-point Likert-type scale with response alternatives ranging from strongly disagree to strongly agree. The measurement items will be modified wherever necessary to suit our research context.

The survey instrument will be pilot tested in two-phases: firstly, a panel of researchers will review the instrument, then a panel of at least 3-5 expert practitioners will pilot test it. Web or Internet based surveys are seen as achieving higher response rates due to their ease of use, low cost and greater interactivity (Dillman 2007). The survey will thus be replicated in a web-based form, so that respondents can use either paper or an online questionnaire to submit their responses. A link to the online questionnaire will be provided in the covering letter. To avoid duplication, a separate postcard (bearing return address and postage stamps) which has respondent identifier and a pre-written statement, will also be included with the first mailer to encourage respondents to acknowledge submission of survey response.

Data analysis will be carried out using a two-step approach: assessing the measurement model, and then the structural model for adequacy of data representation. The measurement model will be tested for validity and reliability properties. Construct validity will be assessed by convergent and discriminant validity, using confirmatory factor analysis (CFA).

CONCLUSION

This research study aims to enrich our understanding of the innovation process of ERP. While a large number of empirical and non-empirical studies have made valuable contributions in identifying several CSFs to implementation stage of ERP innovation process (see for example: Bhatti, 2006) and assessing ERP success (see for example: Gable et al. 2003); neither these studies have been able to deliver a generally agreeable and conclusive set of CSFs to successful ERP innovation process (Ngai et al. 2008), nor the failure and implementation difficulties of ERP projects have subsided (Leung 2008).

In essence, this study thus takes a step forward in proposing a new systematic direction to research on CSFs of ERP in particular and innovation process of complex technologies in general. By adopting a structured and integrated approach, the study attempts to plug the shortcomings of traditional CSF oriented studies. The finings of the study are expected to have several important implications including: a) improving our understanding of adoption stage of ERP as prior research findings have been largely concentrated on implementation stage of ERP b) identifying new factors that could improve the predictive power of diffusion theories in explaining the uptake of complex technologies including ERP c) providing a better understanding whether role of CSFs is limited to influencing the outcome of relevant stage in an innovation process or it goes beyond that in influencing the performance of firms as well d) providing understanding of the impact of successful adoption and implementation of ERP on the performance of the firms studied, and e) laying the foundation of a new theoretical framework of 'successful adoption and implementation of ERP' which will comprise of CSFs to each stage of innovation process and examine their validity and impact on performance of the firms studied.

Though research study provides a unique perspective to CSF oriented literature, it has several limitations as well. Firstly, it examines limited number of factors to ERP innovation process, therefore future research would be required to test more variables to identify a generally agreeable set of CSFs. Secondly, the research study does not take into account cross-border and cross-cultural issues in ERP innovation process, which could be critical in ERP context as several businesses implement ERP on global basis. Finally, the study limits its focus on testing CSFs to only two stages of innovation process and further research would be required to identify and examine the CSFs to other stages in ERP innovation process such as use, incorporation and retirement phases.

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