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Exploring antecedents of organisational adoption of ERP and their effect on performance of firms

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Abstract

The research aims to address the existing theoretical gap in knowledge on antecedents to organisational adoption stage of the Enterprise Resource Planning (ERP) innovation process, and their relationship to performance of the firms. The predominant focus on investigating the implementation stage and its related issues has resulted in relatively limited understanding of the other stages of ERP innovation process. Additionally, little is known on how important critical success factors (CSFs) are to performance improvements of the firms. Grounded in innovation diffusion & IS Success theories, this study attempts to identify the antecedents critical to the success of the adoption stage of ERP innovation process and then examine their effect on organisational performance . Employing a mixed method research design for data collection and Structural Equation Modelling for analysis, the study empirically test a research model in order to develop an integrated, holistic framework for success of ERP innovation process. This research expects to contribute to the development of theory on innovation process by testing new antecedents to ERP adoption stage context as well as enhancing the understanding of CSFs' role. The study will also provide recommendations for both the potential adopters and the vendors on successful uptake of ERP system.

Keywords: Adoption, Enterprise Resource Planning, Critical Success Factors, Firm Performance.

1 INTRODUCTION

Innovation is increasingly being hailed as the transformative engine that creates and shapes new economies of today's networked world. The growth and survival of businesses is linked both to the creation of new products and services and to the adoption of novel ways of doing business whilst constantly improving the internal business processes, procedures, policies and business models (Damanpour & Schneider 2006). This 'innovation pressure' is thus translating into a tendency among firms to adopt information and communication technology / system (ICT/IS) innovations. One such technological innovation is the Enterprise Resource Planning (ERP) system.

With its hallmark enterprise-wide information sharing capabilities, ERP has gained popularity as the most rewarding information system of the 21st century (Davenport 2000). Paradoxically, the popularity of ERP does not seem solely to stem from its potential and promised benefits, but also partly comes from its notoriety for being complex to implement and various instances of its failed implementations (Ehie & Madsen 2005, Mabert et al. 2003). Reporting accurate information on ERP failures might be difficult if not impossible. However, it is generally believed that an estimated 60-70% of ERP projects, either fail to implement successfully or face various obstacles during implementation (Harvard 2007, Leung 2008). While such estimates seem very alarming, the lack of clear understanding on how ERP systems can be implemented successfully is still vague, thus adding to the burgeoning problem.

ERP projects fail due to a variety of reasons. Some of those reasons are: the complexity of the implementation process, misfit between ERP and organisational business processes, lack of availability of skilled human capital, cross-functional coordination issues, inappropriate planning and project management and incompetent consultants (Kim & Lee & Gosain 2005). All these reasons seem to embody one common theme: that is a sound understanding of the innovation process is essential in order to realise success in ERP projects (Laukkanen & Sarpola & Hallikainen 2007). This realisation has led to extant research, in terms of both the volume and diversity, on ERP related themes such as CSFs to ERP implementation, change management, cultural issues, trends and perspectives, use, maintenance and cross border implementations etc. (Moon 2007).

Despite the proliferation of studies on ERP, the research examining the organisational innovation process of ERP is still at a preliminary stage (Mabert et al. 2003) whereas the research on the adoption stage of the process is scant. The organisational innovation process is the combination of various stages or phases 'along the temporal dimensions of their anticipated sequence' (Rogers 2003, Zaltman & Duncan & Holbek 1973 p.52). Suffering from a lack of consensus on a globally accepted subdivision and nomenclature for the stages of an innovation process, the theorists have commonly identified these stages as initiation, matching, adoption, implementation, use and retirement of innovations (Kwon & Zmud 1987, Rogers 2003). The literature review indicates that the major thrust of the research on ERP has concentrated on the implementation phase generally and CSFs to ERP implementation in particular (Esteves & Bohorquez 2007, Moon 2007). This trend has resulted in a relatively limited understanding of the other stages of ERP innovation process such as adoption, use and retirement (Kamhawi 2008). Perhaps, the peculiar focus on investigating ERP implementation process is either the outcome of a sense of urgency among the researchers to find a 'mantra for success' to curb or to slow down the failures of ERP implementations, or it may be due to the reason that implementation, in ERP research context, is being treated as an inclusive process combining initiation, adoption, implementation and use. Regardless of the reason, it is crucial to avoid this "one size fit all" approach and any conceptual overlap between implementation and other stages of the ERP innovation process. This avoidance is vital, since understanding of each stage will enable the firms to proactively seek relevant solutions for achieving success at each specific stage of the ERP innovation process. Without diagnosing every stage of the ERP innovation process specifically, it seems unlikely that sound solutions to problems in ERP projects can be developed and its failures can be reduced or eliminated (Peslak & Subramanian & Clayton 2008). Equally important is the fact that the literature on ERP implementation is characterised by inconsistent, inconclusive findings and it lacks maturity (Ngai

& Law & Wat 2008). Therefore, there is a need for a fine-grained and well-structured approach to research in ERP context (Finney & Corbett 2007).

The adoption stage is the decision making stage in an innovation process (Rogers 2003, p.420). This is a very important stage as the ERP adoption decision entails huge monetary and resource commitments. An incorrect adoption decision could 'well jeopardise the very existence of the organisation'. A well grasped understanding of CSFs relating to the adoption stage can help firms to achieve savings in costs, time and reduce the risk of failures by creating a more ideal environment and adequately preparing themselves (Verville et al. 2005). Furthermore, the identification of CSFs specific to every stage of the innovation process is of paramount essentiality, as each stage has different focus, priorities, stakeholders and performance metrics. With a very limited research on CSFs to ERP adoption stage, this study addresses these gaps in knowledge by investigating the factors critical to the success of adoption stage.

Though the significance of CSFs is recognised, little is known about whether the impact of CSFs is limited to the success of the relevant stage alone or does it extends beyond that, influencing the performance of firms in long run. Therefore, the study investigates the relationship between CSFs to adoption stage of ERP and their performance impacts on firms. An investigation of this relationship is vital in order to understand the real impact of CSFs (Nicolaou 2004).

Finally, literature presents a strong case for examining factors specific to the adoption of complex ICT/IS innovations, as the conventional factors presented by classical innovation diffusion theories (e.g. Rogers 2003) may not prove to be strong predictors to understand the innovation process of complex technologies (Hong & Zhu 2006). As such, the study fulfils this gap by testing factors specific to ERP adoption in particular and complex ICT/IS in general.

In the context of the literature gaps discussed above, this study investigates the following questions:

- What are the antecedents critical to successful adoption of ERP?
- What is the impact of successful adoption of ERP on the firm performance?
- What are the effects of CSFs for adoption of ERP on performance of firms?

This paper is organised as follows. First, in Section 2, a review of the literature pertaining to ERP adoption, implementation problems, CSFs and performance impacts is presented. In Section 3, the theoretical foundation of the study is discussed. Next, a theoretical framework identifying antecedents and their structural relationship is proposed in Section 4, followed by a discussion of methodology in Section 5. Finally, the implications and limitations of the research are discussed in Section 6.

2 LITERATURE REVIEW

2.1 ERP: significance and implementation problems

ERP, a term coined by the Gartner Group in the early 1990s, is a commercially available off-the-shelf software system, which embeds best business practices (Cotteleer & Bendoly 2006, Mabert et al. 2003). ERP offers extended functionalities to support critical business processes in many functional areas throughout the whole enterprise as compared to its specific-purpose predecessor systems such as Material Resource Planning (MRP) and Manufacturing Resource Planning (MRP-II) system of 1960 and 1970 respectively (Mabert et al. 2003). SAP, Oracle, Baan, PeopleSoft, JD Edwards, Technology One and MS Dynamics NAV are some of the well-known ERP systems.

ERP enables process and information integration across all functional domains of an organisation. It is defined as the customisable, modular structured software system that embeds best business practices and seeks to automate, standardise and integrate the key business & management processes and information using a common database and IT architecture; and provide real time information flow (Mabert & Soni & Venkataramana 2003).

The investment in ERP entails a variety of tangible and intangible benefits. Shang and Seddon (2000) and Basoglu, Daim and Kerimoglu (2007) list some of the benefits: (a) operational as in: reduced operating costs, accurate demand forecasts; (b) managerial as in: improved decision making and better resource management; (c) strategic as in: greater support for business alliances, building business innovations and cost leadership; (d) IT infrastructure as in: building business flexibility; reducing ICT costs; and (e) organisational benefits as in: supporting organisational change, facilitating better communication, business learning and empowerment. Historically, however, the implementation of ERP was carried out to replace fragmented, multiple, difficult and costly to use & maintain legacy systems – a transition that was neither easy nor quick.

Basoglu et al. (2007) cited figures from a Standish Group report on ERP implementation, note that ERP projects are, on an average, 178% over budget, take 2.5 times longer than intended to implement; and deliver only 30% of the promised benefits. Supporting this line of argument, several other researchers have reported a number of failed ERP projects with some of the projects involving multinational firms, including Boeing, Siemens, Panasonic, NAB Australia, AeroGroup, Dell, FoxMeyer, Whirlpool, and Dow Chemical (Ferguson, 2004, Karim & Somers & Bhattacherjee 2007). On the contrary, several ERP projects have been implemented successfully or have resulted in a number of benefits to adopting organisations too. Some examples are: IBM Storage system which achieved a reduction in shipment time for replacement parts from 22 days to 3 days, and Par Industries which reaped delivery performance improvement from 60% to 95% with a lead time to customers reducing from 6 to 2 days (Ehie et al. 2005).

The foregoing discussion highlights the opportunities and risks associated with adoption of ERP systems. Indeed, a failed ERP project could entail a potential disaster to the survival of the adopting organisation.

2.2 Critical Success Factors (CSFs)

The concept of critical success factors was originated in 1960s and it gradually gained practical acceptance in 1970s when it was used for the design of a management control system (Leidecker & Bruno, 1984). Since then, it has been variedly used across different disciplines such as organisation behaviour, business, management, marketing and information technology / systems. Also named as strategic factors, key success factors, key result areas and pulse points; the CSFs have been widely conceptualised as the 'few key areas where things must go right' for the firms to achieve competitive performance and profitability (Leidecker & Bruno 1984 p.23, Rockart 1979). Hofer and Schendel (cited in Leidecker & Bruno 1984) proposed a deterministic view of the concept and described CSFs as those areas, which can be influenced by management decisions to achieve competitiveness – a view that seemed limited in conceptual utility and sounded too simplistic. However, Leidecker and Bruno (1984, p.24) took a more comprehensive and deeply insightful approach in defining the concept of CSFs as "those characteristics, conditions or variables that when properly sustained, maintained, or managed can have a significant impact on the success of a firm competing in a particular industry." This view and definition are shared and adopted as fundamental concepts in the present study.

The determination of CSFs is vital to organisations, to constantly and sufficiently focus on activities in already identified key areas or in identifying key areas for achieving the performance improvements. CSFs have been classified in a variety of ways such as strategic, tactical, internal / firm specific, external / industry specific, technological / innovation related and environmental (Finney & Corbett 2007, Leidecker & Bruno 1984). Given that the success of the ERP projects has been widely termed as 'a moving target' (Karim et.al. 2007), the identification of CSFs has attracted considerable literary interest. The CSFs are assumed to provide a positive, beneficial effect on the outcome, and thus knowing greater number of CSFs pertaining to a specific innovation process has been considered as critical to success of the process (Karim et.al. 2007). Despite the fact that conceptually CSFs are the areas that are linked to performance impacts on the firms, there seems to be a very significant gap in the literature in understanding the true role of CSFs on the firms studied. Generally, previous studies

investigating CSFs seemed to conceptualise them as an independent object relevant to a certain process, without investigating how critical the related CSF is to performance improvements. This situation warrants immediate attention and requires further examination of the role of CSFs in their interactive effect on performance improvements of the firms.

2.3 Adoption & Performance impacts of ERP

Referred to as a go no-go decision point, adoption is a key stage in the innovation process (Rogers 2003, p. 423) and has been extensively investigated in innovation diffusion literature. It has, however, received little attention in ERP literature as a bulk of studies have focused on investigating the implementation process of ERP (Esteves et al. 2007).

The literature points that assessment of benefits and risks of ERP has remained of strategic interest to the adopting organisations. Achieving operational efficiencies such as improvements in productivity, optimising inventory and data integration capabilities are some of the prime benefits being sought by ERP adopters (Kamhawi 2008). In investigating adoption motives, Raymond and Uwizeyemungu (2007) conclude in their study of Canadian Small & Medium enterprises (SMEs), that the firms with significant organisational capacities, commercial dependence on major customers and tendency of bringing innovative products are internally predisposed to ERP adoption, whereas those firms which are focused on networking and partnerships with other firms are externally pre-disposed towards adoption of ERP. Unfavourably disposed firms are profiled as having less conducive environmental, organisational and technological tendencies towards the adoption of ERP.

Extending the investigation on motives of adoption, Kamhawi (2008) finds that gaining strategic management and decision making capabilities are the main themes influencing ERP adoption decision, whereas startup costs and availability of resources are the main challenges to adoption of ERP. The findings indeed confirm the standpoint of Huang and Palvia's (2001) study in which they highlight the differences in challenges faced by SMEs in adopting ERP, in developing and developed countries. Huang and Palvia (2001) find that the SMEs in developing countries face various cultural, economic and infrastructure challenges to adoption of ERP in contrast to their developed countries counterparts. However, Buonanno et al. (2005) contradict this position and conclude that SMEs do not regard financial constraints as the impediment to ERP adoption, but consider organisational and structural factors as the main influencing reasons thereof.

In an attempt to explore CSFs to ERP adoption, Deep, Guttridge, Dani and Burns (2008) suggest various factors across four key activities: plan, identify, evaluate and select. These factors are core team formation, review of requirement planning, ranking of needs / priorities, list of available resources, software and vendor short list criteria, arranging workshop and demonstration for end-users and customer site visits. Interestingly, Elbertsen, Benders and Nijssen (2006) discover that firms having less knowledgeable people / IT managers, who consider ERP as a complex and incompatible system, exhibit greater receptiveness to ERP marketing efforts and tend to adopt ERP more. The findings point to the opportunities available to ERP vendors for marketing customisable or best-of-breed systems. They also draw attention to the need for ERP vendors to review their marketing approach and step up efforts to target both well informed and less informed potential adopters.

Given the considerable investment of time, money and resources in ERP projects, the researchers have looked at the performance impacts of ERP in a post adoption scenario. Conducting a survey of Hong Kong based firms, Law and Ngai (2007) find that user satisfaction of ERP and business process improvement positively impact the organisational performance. They claim positive empirical relationship between the strategic intent behind the adoption of ERP and organisational performance. Velcu's (2007) study reinforces the above findings, as the study reveals that firms driven by technologically-led motives versus business-led motives, perceive differently towards benefits of adopting ERP. Poston and Grabski's (2001) longitudinal study of pre versus post implementation present mixed financial benefits to the ERP adopters. Hunton, Lippincott and Reck (2003) argue 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.

Among the studies measuring the non-financial impacts of ERP, O'Leary (2004), using data from companies which had opted for Oracle's ERP, identifies several tangible and intangible benefits of ERP implementation. Considering ERP's multi-directional impact, McAfee (2002) observes significant operational performance improvements in the pre versus post ERP implementation contexts. Supporting these findings, Cotteleer and Bendoly (2006) discover 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 three or more years, Matolcsy, Booth and Wieder (2005) report sustained operational efficiencies and overall improved liquidity for adopting firms after the second year of implementation. Similarly, Nicolaou's (2004) study supports 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) concludes 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.

3 THEORETICAL BACKGROUND

3.1 Diffusion of Innovation

Over the past 50 years, innovation scholars have produced a number of theoretical models, terminologies, typologies and nomenclature, to explain the concept and the process of innovation (see for review: Kwon et al. 1987, Rogers 2003, Zaltman et al. 1973). To attribute this situation to the cosmopolitan characteristics of innovation or to the b*andwagon effect* of innovation is a matter of debate which is beyond the scope of this study, however, the resultant literature certainly seem to be converging towards 'a core set of theoretical models' (Kamal 2006). Supporting this line of argument, a review of various theoretical models indicates that the innovation process have been explained through four core processes: generation, diffusion, adoption / implementation and retirement / obsolescence. These core processes have further been divided into sub-processes such as initiation, matching, assimilation, use, and infusion to provide deeper insights into the various stages of the innovation process. Diffusion of innovation (Rogers 2003), IS Implementation Model (Kwon et al. 1987), Technology Acceptance model (Davis 1989), Innovation adoption and implementation Model (Gullivan 2001), Theory of Reasoned Action (Ajzen & Fishbein 1975) and Theory of Planned Behaviour (Azjen 1985) are some of the core models of innovation (Cited in Kamal 2006). The linear, sequential and formulaic approach adopted by these models has attracted criticism (Bayer & Melone 1988) as well as validation in multiple studies across different disciplines (Damanpour et al. 2006, Molla & Licker 2005).

Rogers (2003) has described innovation process from individual as well as organisational lenses, explaining several attributes that influence the process. According to Rogers (2003, p.420), the organisation innovation process is a sequential combination of five stages, which is made up of a two-stage initiation sub-process, namely agenda-setting and matching; and a three-stage implementation sub-process, namely redefining/restructuring, clarifying and routinising. Rogers' (2003) innovation models have been tested in cross-disciplinary contexts and many scholars have presented updates, extensions and revisions to this model. Rogers' (2003) model has also been termed as being too formulaic and lacking in realism (Bayer and Melone 1988). Given the scope of this study, however,

the authors employ Rogers' (2003) stage-based organisational innovation model as it lends well with the objective of the study.

3.2 IS Implementation Model

Consistent with Rogers'approach, Kwon and Zmud (1987, p.233) proposed a multi-stage model of IS implementation, theorising that organisational innovation follows six stages, namely initiation, adoption, adaptation (development/installation), acceptance, use and incorporation. Extending Rogers' (2003, p. 392) five-stage organisational model, the IS implementation model emphasises that four assessments: acceptance, usage, performance and satisfaction, should be incorporated into the innovation process model, as these assessments form the basis for implementation success. Since, the IS implementation model has been widely tested and has proved robust in explaining the organisational innovation process of information systems, this model serves as a framework in the present study.

3.3 IS Success Model

Delone and McLean (1992), in their 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, had led to the addition of dimensions such as service quality, intention to use and Net benefits (replacing organisation impact construct) (Delone and McLean 2004).

4 RESEARCH HYPOTHESES AND MODEL

This study uses a synthesis of three models described above to test attributes critical to the adoption of ERP and their effect on firm performance. Consistent with broad category of attributes identified in these theories, the research uses environmental, technological / innovation related, organisational and IS Success related factors to create a hypothetical model, which is shown graphically in Figure 1.

1) Perceived 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 & McLean 2004; Nelson & Todd 2005). Information quality has been found to relate positively to user satisfaction (Nelson & 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. It is thus argued that ERP's perceived information quality is a positive contributing factor to adoption decision, and the following hypothesis is developed:
H1: ERP's ability to provide information quality positively influences the successful adoption.

2) Perceived 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 & McLean 2004; Nelson & Todd 2005). It has been seen as an important factor for ERP implementation and was positively associated with user satisfaction (Nelson & Todd 2005). ERP systems are believed to provide integration, flexibility, and optimum resource utilisation – and thus provide high system quality. It is therefore argued that ERP's perceived system quality capabilities will be an important factor to adoption and its success thus develop the following hypothesis:
H2: ERP's ability to provide system quality positively influences the successful 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 & Akhavan & Hoorali 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 & 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 & Mahajan & Balasubramanian 2003). Organisational readiness positively impacts adoption of technological innovations (Molla & 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 it is hypothesised:

H3: Organisational readiness positively influences the successful adoption.

4) Environmental Assessment

Chi, Jones, Lederer, Li, Newkirk, and Sethi (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 & 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. It is therefore postulated:

H4: An Environmental assessment characterised by environmental hostility, dynamism and heterogeneity positively influences the successful adoption.

5) 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 & 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 it is argued that a positive assessment of ERP's perceived strategic value would contribute to successful adoption of ERP. Thus the following hypothesis is developed:

H5: Higher Perceived Strategic Value of ERP positively influences the successful adoption.

6) Adoption, Implementation Success and Firm Performance

Success of ERP adoption is dependent on combination of various factors. A clearly defined vision and mission, the top management support and leadership, the detailed evaluation and selection process of ERP vendor and a detailed cost benefit analysis of the ERP project are the foundation stones for the success of ERP project at implementation stage and post-implementation performance of the organisation. This study adopts these items to measure the adoption of ERP and its success. Literature suggests that the implementation success have been measured in variety of ways, such as ERP project success, performance of ERP etc. Implementation in this study has been measured in terms of project success using four items: completion on time, within budget, as per expectations and level of user satisfaction with the ERP. It is argued that performance should be measured as the outcome of adoption and implementation of ERP, in order to understand the impact of ERP in post adoption and implementation context. Hence firm performance has been measured by two underlying latent variables: competitive advantage and overall performance of the firm. Dehning & Stratopoulos (2002) suggest "a company achieves competitive advantage by implementing a value creating strategy that is not being implemented by competing firms." The adoption of strategic information systems such as ERP have been linked to achieving capabilities such as agility in offering innovative products and services, effective leveraging of resources, raising entry barriers for new competitors, achieving increased bargaining power with suppliers and customers and changing the dynamics of competition (Bhatt & Grover 2005). As such a ten-item measure as proposed by Teo and Pian (2004) has been adopted to tap into competitive advantage gained by the organisations in post ERP context. Overall performance of the firm is measured by seven item measure to check the impact of ERP on customer service, productivity and sales growth of the adopting organisation. Based on foregoing discussion, we argue,

H6: Adoption success positively influences implementation success.

H7: Adoption success positively influences firm performance.

H8: Implementation success mediates the relationship between adoption success and firm performance.

H9 : Perceived information quality, perceived system quality, organisational readiness, environmental assessment and perceived strategic value have positive relationship with firm performance.

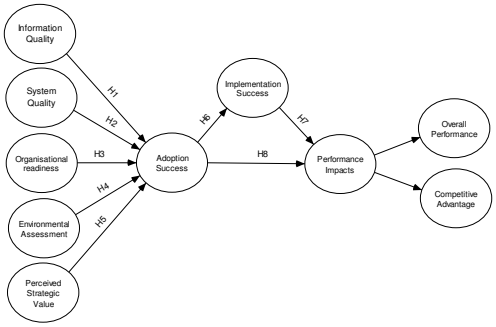

Figure 1. Preliminary Research Model

5 RESEARCH METHODOLOGY

This research project is designed to empirically test and validate the hypothetical structural model presented in Figure 1. The study employs a mixed method approach in data collection. The quantitative data will be gathered through a cross sectional survey and be used to identify the influence of various organisational, technological / ERP related, environmental and IS Success related variables on the adoption stage and their effect on the performance outcomes of the firms studied. It will be followed by semi-structured interviews with respondents in five firms to supplement and cross-validate the findings of the survey and probe further insights into the issues. Given the complex nature

of ERP adoption and implementation process, the choice of mix-method approach suits the objectives of this study as it will allow the testing of the hypothesised relationship among various factors as well as explore in greater depth the process by which the relationship among these factors occurred (Tashakkori & Teddlie 2003). The data collected through the cross-sectional survey is expected to provide greater external validity and generalisability of results, and afford 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, Structural Equation Modelling (SEM) is the most appropriate approach to be used for analysing data.

The population for the study is the Australian organisations that have implemented ERP systems. The sample frame has been 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 the prior research into ICT innovations and given the focus of this study, the target respondent group is senior managers for example: Chief Executive Officer, Chief Technology Officer, Chief Information Officer, Project Managers and business managers with dedicated involvement in the adoption and implementation of ERP in their respective organisations. This set of group is chosen as they 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 (Wu et al. 2003).

All latent variables / factors shown in the model (See Fig. 1 above) are being measured through multiple item scales, which are expected to provide a stronger construct validity. Wherever possible, measurement items which have been operationalised and tested in previous empirical studies have been re-used, which will increase the comparability and reliability of the results. All the items in the survey are being measured using a five-point Likert-type scale with response alternatives ranging from strongly disagree to strongly agree.

A two-phase pilot test of the survey instrument have been conducted, with fifteen academics and nine ERP practitioners / professionals respectively. The feedback has been incorporated into the survey instrument and where necessary modifications have been made to suit the context of the present study.

The web or Internet based surveys are seen as a convenient platform in achieving higher response rates due to their ease of use, low cost and greater interactivity (Dillman 2007). As such the survey questionnaire has been replicated into its web-based version and is available at www.surveymonkey.com. A link to the online questionnaire has been provided in the covering letter. Respondents are given the choice either to respond in hardcopy or online. To avoid duplication, an identifier number has been allocated to each respondent.

Data analysis will be carried out using a two-step approach: (a) assessing the measurement model; and (b) analysing 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).

6 CONCLUSION

This study intends to propose a new systematic direction to research on CSFs on innovation process of complex technologies in general and ERP in particualr. By adopting a structured and an integrated approach, it is believed that the shortcomings of traditional CSF oriented studies could be overcome. The question, how important critical success factors are, requires an in-depth examination of the interactive effect of CSFs beyond the particular innovation process, and to further understand the role of CSFs in the spirit of the concept.

The findings are expected to have several important academic as well as practical implications which include: a) improving our understanding of the adoption stage of ERP through identification of key

attributes to the process. This would help firms to study their conditions against a set of identified CSFs, which is expected to improve their chances of eliminating or reducing the risk of failure or improving the chances of success of their ERP projects (Ngai et al. 2008), b) testing of a new combination of CSFs to ERP adoption, will shed light on the complex interaction and effect of these variables on the performance outcome, c) identifying new factors that could improve the predictive power of diffusion theories in explaining the uptake of complex technologies including ERP, d) providing a better understanding of whether CSFs role is limited in influencing the outcome of relevant stage in an innovation process or it goes beyond in influencing the performance of the firms as well, e) helping ERP vendors to understand the needs of potential ERP adopters, and thus formulate their marketing and product development activities to increase their market share and f) laying the foundation of a new theoretical framework of 'successful adoption' of ERP.

While unique in its design and perspective, the study has several limitations as well. Firstly, it only examines a limited number of antecedents pertaining to ERP adoption stage. As such there is a need for future research in testing more factors in getting an agreeable set of CSFs. Secondly, due to its geographical focus in Australian context, the utility of study's findings in the cross-border and cross-cultural ERP projects context would be limited. Finally, the study provides a snap shot understanding of the adoption stage, and thus do not takes into account the dynamic nature of changes in effect of CSFs to improvements in performance and on the innovation process generally.

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