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***Journal of Engineering and Technology Management*, [vol 33, pp. 113-133 (2014)]**
DOI : 10.1016/j.jengtecman.2014.04.001

Abstract

There has been considerable debate about the role of enterprise resource planning (ERP) in driving competitive advantage. However, little is established empirically on the antecedent factors that could facilitate achievement of such an advantage of adopting ERP. Therefore, this study examines the role of antecedent factors in the organisational adoption of ERP projects for the achievement of competitive advantage. We draw on information system success and information system implementation theories to build a conceptual model to examine the role of antecedent factors in influencing the achievement of competitive advantage. We use the structural equation modelling (SEM) technique to analyse the survey data of 217 Australian companies and test the model. We find that organisations that understand the importance of certain antecedent factors and manage them appropriately can achieve competitive advantage with ERP projects. These factors include consideration of the system quality and organisational readiness at the planning stage for an ERP project.

We have extended knowledge on the role of antecedent factors to successful organisational adoption of ERP by providing evidence that they are also significant predictors for the achievement of competitive advantage. Our study's findings indicate that establishing a clear understanding of necessary system attributes in the organisational context at the adoption stage of ERP is important for helping organisations achieve subsequent competitive advantage. Their understanding of potential system quality attributes, the business environment within which their organisation may operate, the internal organisational capabilities and desired strategic benefits, can help managers and ERP system developers implement strategies, leadership, resources, and commitment to achieve their desired benefits from ERP projects.

Keywords: Adoption, competitive advantage, enterprise resource planning (ERP), structural equation modelling (SEM), partial least squares (PLS), innovation, organisational readiness, system quality, information quality

1. Introduction

Organisations invest in enterprise resource planning (ERP) systems to gain a variety of operational, managerial and strategic benefits (Woo, 2007). While the introduction of ERP within organisations has often been found to be a complex endeavour encountering difficulties and failures (Kanaracus, 2011; Kanaracus, 2012), the evidence shows that a number of organisations have actually achieved improved performance and various tangible and intangible benefits after implementation (Beheshti and Beheshti, 2010; Cotteleer and Bendoly, 2006).

The integrative nature of ERP improves an organisation's information processing, decision making and innovation capabilities and changes the way the organisation interacts with customers, suppliers and other stakeholders within and across organisational boundaries. The fundamental changes brought about by the introduction of ERP can lead to 'significant implications that go far beyond operational efficiency' (Lengnick-Hall et al., 2004, p. 308) and result in operational distinctiveness leading to competitive advantage.

The resource-based view (RBV) of business strategy determination, sees an organisation as a collection of resources and capabilities. Effectively managing these capabilities can lead to unique and firm-specific processes and procedures, resulting in profitability and growth and achievement of competitive advantage (Taher, 2012). RBV theory suggests that to be able to enjoy competitive advantage, organisations need to develop capabilities that 'may be durable, rare, appropriate, non-substitutable, immobile or imperfectly mobile, difficult for others to imitate, and have value in the firm's environment and marketplace' (Taher, 2012, p. 154). However, the need for operational commonality with other organisations that is introduced through the ERP adoption process poses several challenges for developing a unique set of resources.

The literature indicates that ERP can trigger competitive advantage in a variety of ways, for instance, by helping organisations to establish useful links with supply chain partners, achieving agility in product and service differentiation, reducing time-to-market for delivery of products and services, achieving flexibility in adapting to changing customer demands, improving

customer service and customer retention, achieving improved knowledge management and becoming a fluid and responsive organisation (Laframboise and Reyes, 2005; Seddon, 2005).

The introduction of ERP systems within an organisation is generally considered a strategic initiative and aligned with long-term business objectives. Thus, it is expected that organisations will tie investment in ERP to achievement of competitive advantage. The large capital and human-intensive nature of the ERP implementation process necessitates a clear understanding of the long-term effects and benefits that ERP can bring to the organisation. Some authors have argued that adoption of ERP systems can help organisations in establishing a platform for, and is instrumental to achieving competitive advantage (Laframboise and Reyes, 2005). Possessing organisational resources, such as ERP, has been thought to influence competitiveness (Wu and Wang, 2007b). However, the overall evidence for this in the literature remains mixed and no clear picture seems to emerge about the role of ERP in achieving competitive advantage. As such, it has remained a matter of unresolved debate (Seddon, 2005).

We argue that at the adoption stage, an understanding of the role of ERP for facilitating competitive advantage can help an organisation to implement strategies, identify resource complementarities and create a basis for informed resourcefulness to achieve competitive differentiation after ERP adoption (Lengnick-Hall et al., 2004, p. 315). Identifying the drivers, factors and processes that lead to competitive advantage would be crucial to create such strategies particularly early in the process, that is prior to or at the adoption stage of ERP. We propose that studies to investigate this are needed and this line of investigation is consistent with RBV theory. We are aware that a number of prior studies, though not in the ERP context, have shown the relationship between information systems capabilities and resources and competitive advantage (see examples in Taher, 2012) and encourages us to seek an understanding of their role and influence in the way competitive advantage may stem from ERP projects.

One research stream in the strategic management literature on ERP focuses on the identification and management of antecedent factors considered crucial for achieving success at various phases or stages in the introduction of ERP within an organisation. As such, a large number of antecedent factors have been identified for ERP adoption, implementation and use (Kalling,

2003). We argue that it is important to identify within the set of antecedent factors that help to achieve ERP adoption those which can also influence the achievement of subsequent competitive advantage.

We contend that such an understanding will help managers to recognise the importance of specific factors, prioritise these factors and create an action plan to manage them proactively. Managers will also be able to devote resources, allocate priorities and provide leadership in areas where their focus could have a positive influence on achieving competitive advantage. However, as stated earlier, research that provides insight into the role of the drivers, factors and processes leading to competitive advantage from ERP adoption is minimal (Kalling, 2003).

The aim of this study is to provide findings that may contribute to the successful management of ERP adoption in organisations in general and lead to competitive advantage. ERP adoption has been found to face problems and implementation difficulties and there is no evidence to suggest that the adoption of the ERP systems is more or less problematic in Australia than in other developed economies (see example in Kanaracus, 2011; Kanaracus, 2012). Given that ERP systems are standardised packaged applications, we argue that the business case for ERP adoption, the factors driving adoption and, ultimately, competitive advantage will not differ widely across socio-economic boundaries. However, the degree to which antecedent factors influence the achievement of competitive advantage is expected to vary in the context of economic, regulatory and IT infrastructure. The purpose of this study is to identify the factors that may help to achieve competitive advantage so as to create a base case. To what degree these factors vary across countries and regions can be explored through further studies and is outside the scope of our study. Australia is considered economically strong and bestowed with a robust regulatory environment and a well-developed IT infrastructure, which, arguably, could help in the adoption of ERP and generate differential benefits for those organisation that adopt ERP and our study is based there. Given this specific source of our data, we comment on the generalisability of our findings at the end of this paper. This study seeks to fill the above gap in knowledge by investigating the following research question:

- What are antecedent factors for achieving competitive advantage from ERP projects?

Next, we present a literature review that provides the theoretical underpinning of the study. We then outline our research hypotheses and study methodology. This is followed by results, discussion of findings and conclusions. Finally, we indicate the theoretical and managerial implications, limitations of the study and the future research directions. .

2. Literature Review

2.1 ERP and competitive advantage

Organisations invest in strategic information systems to develop specific capabilities, including relationship assets, and managerial and technical competencies to achieve operational efficiencies and long-term benefits (Piccoli and Ives, 2005). An ERP system can deliver competitive advantage to the host organisation when it is well embedded in the day-to-day operation, management and decision-making processes of the organisation (Michael, 2007).

Bhatt and Grover (2005, p. 253) emphasise that the source of IT-based competitive advantage can be better understood by demarcating specific types of capabilities and examining their contributions towards achievement of competitive advantage. They find that capabilities, such as IT business expertise, and the relationship infrastructure contribute to achievement of competitive advantage. ERP systems can help organisations to achieve agility in delivery of products and services and make them better equipped to respond to market dynamism (Koh and Simpson, 2007).

ERP contributes to achievement of competitive advantage when organisations develop strategies and innovations around ERP technology (Molla and Bhalla, 2006). Factors such as being the pioneer, having explicit vision and clear communication, organisational learning, managerial coordination and overall commitment to the development of the system, training and education, system integration activities help organisations to convert the initial benefits into competitive advantage (Molla and Bhalla, 2006; Ram et al., 2014). Laframboise and Reyes (2005) argue that ERP generates competitive advantage indirectly by complementing other resources and capabilities. These findings resonate with earlier work by Holland et al. (1999) who suggest that

ERP may not be sufficient to contribute towards differentiation; however, it can provide baseline systems to combine with bespoke solutions aimed at obtaining competitive advantage.

Other authors have presented another explanation for ERP's role in providing competitive advantage; for example, Utecht et al. (2004) claim that ERP enables improved decision-making capabilities, which are instrumental in obtaining competitive advantage. In another study, the implementation of Systems Applications and Products in Data Processing (SAP) systems helped the studied organisation improve inventory management more than their competitors did, however, did not lead to more improved profitability (Goeke and Faley, 2009). Information and knowledge creation is regarded as the fundamental organisational resource in today's information economies and ERP's capability to improve knowledge management within an organisation, manifested through a number of elements, including organisational preparation for knowledge management, employee education and training, information and data network, knowledge sharing process and knowledge scanning leads, to achieve competitive advantage (Li and Zhao, 2006).

To explore this further, we use an approach that is well established in the strategic management literature on ERP to extend our understanding of how antecedent factors to ERP adoption can contribute to the achievement of competitive advantage.

2.2 Factors in the adoption of ERP

The adoption of technological innovations has been linked to achievement of competitive advantage (Tsai and Tang, 2012). However, the large monetary and people involvement in an ERP system makes the decision to adopt ERP one of the most crucial strategic decisions for organisations of all sizes. The decision has a significant influence on achievement of desired benefits and competitive advantage from the ERP project.

Considerable research effort (Deep et al., 2008; Ram et al., 2013) has been devoted to identification of antecedent factors of the individual and organisational adoption of ERP. Organisation size, structure, knowledge and management capabilities have significant influence on adoption (Deep et al., 2008). However, business complexity has less influence on adoption (Jang et al., 2009).

Organisational readiness has often been found to be an antecedent to technological innovation (Tsai and Tang, 2012), and possessing adequate readiness to implement and use the ERP system is said to be crucial for adoption success (Sammon and Adam, 2010). A number of authors (Capaldo and Rippa, 2009; Raymond and Uwizeyemungu, 2007) have identified the dimensions that need to be assessed to determine organisational readiness at the adoption stage.

A robust business case for investment in ERP not only involves assessment of the degree of organisational readiness from an internal perspective but also requires an understanding of the environment within which the organisation operates and how the organisation can react or respond to it (You et al., 2012). An environmental assessment of competitors, partners, regulations and customers influences organisational adoption of ERP significantly (Ram et al., 2013).

The strategic nature of ERP adoption necessitates an assessment of benefits and risks, and a number of authors (Shiau et al., 2009; Woo, 2007) claim that the perceived benefits of adopting ERP influence the adoption decision positively and the benefits that are generally sought include gaining operational speed and business profitability. Other authors (e.g., Bueno and Salmeron, 2008) find positive association between the perceived value of adopting ERP and individual adoption and use of ERP systems.

However, achieving the perceived benefits is considerably dependent on the ERP system's capabilities and the quality of the system. Quality attributes have been found to be drivers to achieve acceptance at the individual and organisational level, and both system and information quality have been established empirically as critical success factors for individual and organisational adoption of ERP (Fan and Fang, 2006).

The above discussion shows that a number of organisational, environmental and technological antecedent factors have been identified and have significant bearing on the organisational adoption of ERP. However, little is known of their influence on post-implementation outcomes and competitive advantage.

3. The Theoretical Underpinning

The information systems (IS) success model (DeLone and McLean, 1992; 2003), originally developed in 1992 and refined in 2003, theorises the mechanism for achieving performance outcomes or success of information systems. The model proposes that system quality and information quality are key antecedents that individually and jointly influence both use and user satisfaction. Additionally, the degree of user satisfaction is influenced, positively or negatively, by the amount of use, as well as the reverse being possible. Use and user satisfaction then lead to individual impact, which eventually leads to organisational impact (DeLone and McLean, 1992, p. 83–87). The model proposes 'system quality' and 'information quality, as the antecedent factors to 'use' and 'user satisfaction' of an information system.

A number of studies (e.g., Iivari, 2005) have since validated this model empirically in a variety of IS contexts and some also criticise the model for its limitations (Molla and Licker, 2001). The critique on the model led to its refinement with the addition of three new variables: service quality, intention to use and net benefits, and their proposed effects in the model. The IS success model presents antecedents as the drivers of ultimate performance impact on individuals and organisations and, thus, provides a robust theoretical underpinning to our study, as we seek to examine how various antecedent factors influence competitive advantage derived from an ERP project.

We also draw on the IS implementation model (Kwon and Zmud, 1987) to develop the conceptual foundation of this study. The model posits that the introduction of IS in an organisation is manifested through a series of stages, namely initiation, adoption, adaptation (implementation), acceptance, use (performance and satisfaction) and incorporation. The underlying philosophy of the IS implementation model is that introduction of IS leads to

performance outcomes from work on earlier stages and the antecedent factors relevant to these stages.

The IS implementation model describes antecedent factors along various dimensions: specialisation networks (organisational); hostility and competition (environmental); compatibility, complexity and relative advantage (technological); autonomy and responsibility (task related) and cosmopolitanism and education (individual) factors. Both the IS implementation model and the IS success model are synergistic in context and robustly encapsulate the theoretical stance needed for examining the influence of antecedent factors for competitive advantage. Such an examination is also consistent with RBV theory conceptualisation (Taher, 2012). Therefore, we select factors for this study by drawing on these two models, as discussed in the next section.

4. Selection of Antecedent Factors and Research Hypotheses

Given the literature review in Section 2 and the factors proposed by the above two models in Section 3, we conclude that:

(a) some key antecedents that would require examination for their influence on the competitive advantage of organisational adoption of ERP are organisational readiness (includes specialisation and network aspects of IS implementation model), system quality and information quality (IS success model), strategic value (includes relative advantage and organisational benefits context of IS implementation model) and environmental assessment (includes hostility and competition aspects of IS implementation model)

(b) the selected antecedents in (a) that have been found to be critical to the success of individual and organisational adoption of ERP have not been examined empirically for their effect on competitive advantage

(c) examining the influence of selected antecedent factors in (a) on achievement of competitive advantage is useful theoretically and practically in the context of RBV conceptualisation and as proposed in the IS success model and IS implementation model.

Therefore, based on theoretical underpinning and the foregoing rationale, we seek to examine how antecedent factors considered critical to organisational adoption of ERP could influence achievement of competitive advantage. These factors include system quality, information quality, organisational readiness, environmental assessment and strategic value and each will be examined robustly to determine their role in influencing the achievement of competitive advantage from ERP. We define perceived system quality (PSQ), perceived information quality (PIQ) and perceived strategic value (PSV) as the perceptions of managers about the quality and value of the ERP system that they are considering adopting.
The hypotheses for the relationships between the selected factors are set out in the following sections. A conceptual model, driven from these hypotheses, is built and is presented in Figure 1.

4.1 Perceived system quality and competitive advantage

System quality is one of the key enablers of information system success and of achieving desired organisational performance effect (DeLone and McLean, 2004). Wickramasinghe and Karunasekara (2012) note that system quality could generate operational value by assisting organisations with problem solving, autonomy in job performance, management visibility and cross functionality. System quality influences individual and organisational adoption and use of ERP systems significantly and, thus, has great bearing on the ultimate performance outcome of adopting ERP (Kositanurit et al., 2006). Fan and Fang (2006) and Lee and Lee (2012) claim that system quality influences utilisation of the system and affects individual user performance when using the ERP system.

An ERP system with attributes such as easiness to integrate, quality and stable program code and reliable and flexible in meeting users' needs could lead to efficient utilisation of the system through improved human–system interaction (Wu and Wang, 2007a). Such improved interaction is critical for creative use of the system, performance of tasks and productivity of people working on the system (Fosser et al., 2008). A quality system allows organisations to establish profitable partnerships with suppliers, customers and other relevant stakeholders. We contend that a good quality system could facilitate innovativeness in delivery of products, services and operations.

The system quality attributes could improve knowledge management, decision making and operational capabilities, which could then translate into competitive advantage.

A good quality system is expected to have less maintenance and management cost, reflecting a positive value proposition for the adopting organisation. Based on the above argument, we propose the following:

- H1: An organisation's perception of an ERP system's ability to provide good system quality is associated positively and significantly with achieving competitive advantage by adopting ERP.

4.2 Perceived information quality and competitive advantage

The quality of information produced, delivered and presented by an ERP system has significant effect on use and user acceptance of the system (Chien and Tsaur, 2007). Information quality is attributed to influence individual and organisational performance impact (DeLone and McLean, 2003). The accurate, timely and useful information produced by the system could help in sound decision making, agility in delivery of products and services, flexibility in meeting customer needs and improved productivity and user satisfaction (Fan and Fang, 2006; Nelson et al., 2005). It enables organisations to build valued partnerships with suppliers, customers and partners and generate differentiation capabilities.

Beheshti and Beheshti (2010) emphasise that, with greater information quality capabilities, ERP can derive competitive advantage by assisting organisations in developing intellectual capital through improved knowledge management. Thus, the intellectual capital generated can be used to induce product, service and operational innovations and growth of the organisation as a whole.

The increased visibility of information combined with timely and well-formatted information output is critical to ERP users to perform their tasks efficiently and effectively (Berchet and Habchi, 2005). A system with good information quality attributes is expected to facilitate improved user interaction, experience and trust with the system (Nelson et al., 2005; Zhou et al., 2010).

We argue that a determination of information quality at the adoption stage is expected to help organisations plan and prepare to achieve value through effective use of the system, development of management and operational capabilities (Fosser et al., 2008). In light of prior empirical findings and the above discussion, we investigate the following hypothesis:

- H2: An organisation's perception of an ERP system's ability to provide good information quality is associated positively and significantly with achieving competitive advantage by adopting ERP.

4.3 Organisational readiness and competitive advantage

The adoption of ERP brings about far-reaching structural, cultural and people-related changes across the entire organisation. A determination of readiness of the organisation's capabilities and resources at the adoption stage could be crucial in achieving the desired value of adopting ERP. Doherty and Terry (2009) find that IS capabilities, such as IS infrastructure, IS technical skills, IS business partnerships and external relationships, indeed contribute to achievement of competitive advantage.

An organisation that has well-developed in-house capabilities with the appropriate staff skills, technological infrastructure, policy set, standards, procedures and guidelines and financial soundness is expected to operate and maintain an ERP system more successfully and to have improved chances of gaining value and benefits from adopting it. A well-prepared organisation is also expected to handle system bugs and errors, troubleshoot system problems proactively, attend to user-initiated change requests and, thus, be able to promote effective and efficient system utilisation, resulting in creation of differential value and improved organisational performance.

Therefore, it is expected that a determination of organisational readiness will help organisations derive competitive advantage from ERP. Hence, we postulate the following:

- H3: Organisational readiness is associated positively and significantly with achieving competitive advantage by adopting ERP.

4.4 Environmental assessment and competitive advantage

Building superior resources, product and service differentiation, diversity in product line and innovation to competitors is vital to the creation of competitive advantage. To develop such capabilities, organisations need to understand the environment, including competitors, suppliers, customers, regulations and potential partners. Environmental assessment has been found to influence organisational adoption of ERP (Ram et al., 2013). Conducting an environmental assessment will help organisations to devise strategies, putting relevant plans in place and deriving leadership to achieve differential benefits and competitive advantage after ERP adoption. Thus, we study the following hypothesis:

- H4: Conducting an environmental assessment is associated positively and significantly with achieving competitive advantage by adopting ERP.

4.5 Perceived strategic value and competitive advantage

PSV signifies 'the relative advantage' or the opportunity of realising value from an IT investment (Kuan and Chau, 2001, p. 509). It can be gained through improvements in operational support, managerial productivity and strategic decision aid (Subramanian and Nosek, 1993). It is thought to influence ERP adoption (Shiau et al., 2009).

It is plausible to argue that an understanding of the strategic value of adopting ERP in terms of reduction in operational costs, improvements in customer service, improvements in managerial decision making and support to operations is crucial to the implementation of strategies that could help in the achievement of operational differentiation and possible competitive advantage. Doherty and Terry's (2009) findings support the above argument as they claimed that IS planning contributions and cost-effective operations produce competitive advantage.

Based on the above discussion, we propose the following hypothesis:

- H5: An organisation's understanding of the PSV of ERP is associated positively and significantly with achieving competitive advantage by adopting ERP.

INSERT FIGURE 1: THE CONCEPTUAL MODEL

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5. Research Methodology

5.1 Instrument development and data collection

The study used a five-point Likert-type scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5) for measurement of the variables used. We used well-established, empirically tested multiple reflective indicator items drawn from prior studies, as they were expected to demonstrate good content validity.

We operationalised the study's constructs, as described next. We borrowed a five-item construct for PSQ measuring reliability, flexibility, integration, timeliness of information and ease of information access from Iivari (2005) and Nelson et al. *(*2005). We measured PIQ using a four-item construct including items of completeness, accuracy, format and up-to-datedness of information adapted from the studies by Iivari (2005) and Nelson et al. (2005). The six items to measure the organisational readiness construct, covering awareness of benefits of adopting ERP, human resources skills, technological resources, business resources and culture and financial resources availability for deploying ERP systems, were taken from studies by Fathian et al. (2008), Molla and Licker (2005) and Tan et al. (2007). We measured the environmental assessment construct using six items, which included tough price competition, competition in product/service differentiation (environmental hostility), unpredictability of competitors, product/service becoming obsolete quickly (dynamism) and diversity of product line, diversity in customer buying habits (heterogeneity), adapted from Newkirk and Lederer's (2006) study. We borrowed a six-item PSV construct from Grandon and Pearson (2004) and Subramanian and Nosek (1993) to measure the benefits of ERP adoption in managerial decision making, operational efficiency and operational support dimensions. The competitive advantage construct was measured using ten items from Teo and Pian's (2004) study covering dimensions including forming business alliances, differentiation, growth, cost reductions and innovation.

We performed a two-step pre-test of the survey instrument. In the first step, fifteen academics with relevant knowledge of the topic were invited to review the survey instrument, which was followed by ten practitioners in the second step. Revisions from both led to various improvements in format, presentation and content clarity.

5.2 Survey sample, target respondents and data collection

The data were collected from companies based in Australia, as this presented several potential advantages. Australia has high penetration of information technology systems applications in companies, many of which have installed ERP, so a potentially large sample would be obtainable (ABS, 2013a). As ERP vendors are focusing on small and medium enterprises (SMEs) to accentuate ERP uptake, this presented another opportunity because a sizeable percentage of businesses in Australia are SMEs (ABS, 2013b; D'Aquila et al., 2009; Moad, 2009). Additionally, Australia has a reliable postal service that would enable data collection via mail. Finally, Australia has a well-established research culture, as the existence of many universities in the country has led to a supportive and understanding culture for research, and it was believed that this would aid in gaining a satisfactory response from company executives.

5.2.1 Sample frame

The unit of analysis of this study is the organisation. Therefore, Australian organisations that have implemented ERP formed the basis of the sample frame for our study. Initially, two major ERP vendors (SAP AG and the Oracle Corporation) were approached to provide the contact details of their clients; however, for legal reasons, they had to decline. A list of companies was obtained from Fairfax Business Research, a major research company, which is a division of a major newspaper and business magazine publishing company. This research company and its databases have a good reputation for accurate information, and the database we were able to purchase included details on companies that had implemented ERP. Our use of such a database is consistent with similar studies on ERP (e.g., Karimi et al., 2007; Wang et al., 2006; Wang et al., 2008).

5.2.2 Sampling strategies

We considered various ways of obtaining a sample from the database, such as probability sampling, purposive sampling, convenience sampling and mixed method sampling. We wanted senior managers to be the respondents to our questionnaire; therefore, we were concerned about likely response rates, since managers are usually time-poor people.
As explained in section 5.2.1, the sample frame of Australian organisations that have adopted and implemented ERP was obtained by purchasing the well-regarded Fairfax Business Research's 'MarketBase' companies database. The database provided us with information on 2000 companies across a wide range of sizes and industries, which included company name, address, telephone number, details of senior contact persons, the name of their ERP system and the annual company turnover. With the addition of two more organizations that were not part of the original dataset, a package containing a letter, a hard copy of the survey questionnaire, a reply paid envelope and a link to an online version of questionnaire was sent to 2,002 organisations. The target respondents were senior managers, including chief executive officers (CEO), chief information officers (CIO), chief technology officers (CTO) and business managers with specific involvement in ERP projects. It was expected that such people would have good knowledge and/or been involved in the decision-making processes and behaviours in the organisation associated with the adoption of ERP (Wu et al., 2003). The main characteristics of the respondents are summarised in Table 1.

Three follow-up prompts were made to these organisations to encourage response to the questionnaire (Teo and Pian, 2004), which led to 217 completed questionnaires, giving a response rate similar to that of several studies (Fan and Fang, 2006; Law and Ngai, 2007; Ramamurthy et al., 2008; Somers and Nelson, 2004; Velcu, 2010). Eight cases had to be excluded because they did not meet our criterion (that an ERP had to be fully implemented), leaving 209 cases as the basis for our subsequent detailed analysis. It is known that the PLS approach has the ability to work well with small sample sizes (Cassel et al., 1999; Falk and Miller, 1992; Urbach and Ahlemann, 2010), and a sample size of 100 (Chin, 1998, p.311) or 150 (Urbach and Ahlemann, 2010) is generally considered sufficient for PLS modeling. Since, our

sample size of 209 was much bigger than the general requirements, and hence was sufficient for performing further data analysis.

INSERT TABLE 1: RESULTS OF THE DESCRIPTIVE ANALYSIS OF THE SAMPLE

5.3 Data adequacy analysis

Consistent with prior studies (e.g., Chen and Wu, 2011), the data were checked for non-response bias by performing an independent sample t-test for early versus late respondents on the five demographic characteristics: year of ERP implementation, organisational size, type of ERP, industry type and job title. The results of the test did not show any significant difference ($p >$ 0.05, two-tailed test) between early and late respondents on any of the five characteristics. Therefore, we conclude that non-response bias is not likely to be a limitation in this study.

To examine data for the presence of common method variance (CMV), we performed the Harman's single factor test (Podsakoff et al., 2003). The results of the exploratory factor analysis showed the presence of ten factors. Further, the first factor explained 20.95 per cent of the total variance of 64.60 per cent. We also conducted a CMV test following recommendations in Lindell and Whitney (2001) and Williams et al. (2010) by introducing a marker variable 'common method factor' in the model. The results confirmed that average variance explained by the marker variable is very low. Given these evidences, we conclude that it is unlikely that the data are affected by the presence of CMV.

6. Results

6.1 Assessment of the measurement model

We analysed data using SmartPLS 2.0 PLS path modelling (variance-based SEM) because it is considered relatively less sensitive to the violation of assumptions of normality (Chin, 1998; Henseler et al., 2009). The quality of the measurement model was examined by checking for the construct reliability, convergent validity, discriminant validity and standardised factor loadings

of each construct in the model (Henseler et al., 2009). To report the results, we use the terms 'latent variable' (LV) and 'construct' interchangeably from here onwards.

The analysis of the measurement model shows that all constructs in the model demonstrate adequate internal consistency reliability, as the composite reliability (CR) value of each construct is greater than 0.80 (see Table 2), well above the general threshold level of 0.70 (Nunnally and Bernstein, 1994; Urbach and Ahlemann, 2010; Werts et al., 1974). In addition, Cronbach's alpha values are higher than the general requirement of 0.7 (Cronbach, 1951; Nunnally and Bernstein, 1994) for four constructs, and are 0.67 for the other two constructs i.e. PIQ and PSQ (Table 2) which while marginally lower than 0.7 are still well within the acceptable range of 0.6 to 0.7 as recommended by George and Mallery, (2003) and Kline, (1999). These results confirm that the constructs have satisfactory internal reliability. Further, since more than one measure for reliability was used and all constructs met reliability on at least two of three measures, hence reliability is acceptable.

Further, the average variance extracted (AVE) value for all constructs in the model is higher than 0.5 (see Table 2), which confirms that the LVs possess convergent validity i.e., more valid variances than errors in the measurement items are explained by the LVs (Chin, 1998; Fornell and Larcker, 1981). We also checked discriminant validity of the constructs by calculating the square root value of the AVE for each construct. It was greater than the correlation values with all other constructs (see Table 2), which confirms that all LVs in the model possess adequate discriminant validity. Additionally, the cross loadings (see Table 3) are lower than the constructs' factor loadings, which also confirms the discriminant validity of the constructs.

We also examined the factor loadings of each item for all constructs in the model (Chin, 1998; Götz et al., 2009). The results (see Table 2) show that all measurement items are significant at $p < 0.001$. Keeping in context the PLS characteristics of consistency at large which suggests having more indicator items, we followed the recommendations in Henseler et al. (2009) to keep items that have factor loading of less than 0.7 but above 0.4 for analysis of the model.

Initially the AVE values for CADV, EVA, OGRD and PSQ constructs were less than 0.5 and so we removed a total of seven indicator items (three from CADV, one from EVA, two from OGRD and one from PSQ) with lower standardised factor loadings to bring the AVE values of

constructs to the required threshold level of 0.5. This left us with 30 indicator items in the model from which all estimation results were derived.

INSERT TABLE 2: RESULTS OF THE ANALYSIS OF THE MEASUREMENT MODEL

INSERT TABLE 3: CROSS LOADINGS

6.2 Assessment of the structural model

We examined the structural model by assessing three criteria: R^2 values of dependent/endogenous LVs, path coefficient values and the goodness-of-fit (GoF) value for the model (Henseler et al., 2009; Tenenhaus et al., 2005). We present the results in Figure 2 and Table 4.

INSERT FIGURE 2 AND TABLE 4: THE RESULTS OF PLS ANALYSIS

The R^2 value shows that the exogenous variables PSQ, PIQ, organisational readiness, environmental assessment and PSV collectively explained 32.23 per cent of the variance in competitive advantage, which is adequate. Chin (1998) recommends that R^2 values of 0.67, 0.33 and 0.19, respectively, can be interpreted as substantial, moderate and weak for dependent variables. Whereas, Falk and Miller (1992) recommend 10 per cent variance as adequate for testing the predictive power of the models. However, the adequacy of the R^2 value also depend on the specific research discipline (Hair et al., 2011). In this regards, we find that the proportion of variance in competitive advantage, as explained by this study, is comparable to several other studies; for instance, Er-ming et al. (2009) report 20 per cent variance; Evans et al. (2005) report 31 per cent variance; Newbert (2008) report 32 per cent variance; Rose et al. (2012) report 56 per cent variance; and Yee et al. (2010) report 33 per cent variance in competitive advantage. We

thus conclude that the R^2 value or the proportion of variance in competitive advantage explained in this study is robustly acceptable.

We found that PSQ (β=0.3182, p<0.01), OGRD (β=0.1650, p<0.01), EVA (β=0.1982, p<0.01), and PSV (β=0.2046, p<0.01) have significant positive effects on CADV, but PIQ (β=-0.0094, p>0.05) has a non-significant negative effect on CADV, where the numbers in parentheses refer to path coefficients and the corresponding significance levels. These results are given in Figure 2 and Table 4, and will be analysed in detail in the next section.

We also calculated the GoF value for the model by following the recommended procedure given by Tenenhaus et al. (2005, p. 173). The results show that the GoF value of the model is 0.41, which demonstrates a large model fit, as GoF values of 0.1, 0.25 and 0.36 signify small, medium and large values, respectively (Wetzels et al., 2009). The above assessments of the structural model demonstrate that the study's model is adequate.

7. Discussion of Findings

Prior research on ERP has focused on the investigation of ERP's capabilities and role in the generation of competitive advantage (Laframboise and Reyes 2005; Molla and Bhalla, 2006). Little research has been undertaken into whether and how antecedent factors to ERP's adoption and implementation processes could help create competitive advantage. Our study finds that a number of antecedent factors that are considered critical to ERP adoption are also associated with generation of competitive advantage. While earlier studies have found some evidence of certain factors, for instance, knowledge management, being linked to achievement of competitive advantage (Laframboise and Reyes, 2005; Seddon, 2005), no study to date has established empirically that the antecedent factors for ERP adoption are also antecedents for achieving competitive advantage from ERP projects. Our study now provides such evidence.

This evidence is very significant from theoretical and practical perspective; while a large number of antecedent factors have been identified for successful implementation of ERP projects, little is known about the effect these factors have on the long-term benefits of investments in ERP. The findings of our study have therefore enhanced the usefulness of certain antecedent factors by

providing empirical evidence of their effect on the competitive advantage gained by ERP projects. In terms of the practical application of this evidence means that managers can achieve value out of their investments in ERP by carefully managing certain antecedent factors early on in the deployment process of ERP within their organizations.

The findings of this study support the need for a reliable, flexible and adaptable ERP system that can improve supply chain efficiency, transaction speed, brand distinguishability and provision of customised products and services (Fan and Fang, 2006, Table 2). The findings have supplemented the prior research on importance of organizational readiness (Sammon and Adam, 2010; Tsai and Tang, 2012), by showing that an organisation's readiness, in terms of people skills, necessary infrastructure and financial resources, is important for developing unique capabilities in product and service provision and operational efficiencies from adoption of ERP systems. However, organisations need to analyse the business environment carefully for the predictability of competitor action, product and service diversity and price competition to identify areas where ERP can help them in achieving competitive benefits. Our findings suggest that an understanding of the potential strategic value of ERP in terms of potential cost reduction, customer service improvement and managerial decision making is important for setting up the opportunity for achieving competitive results. It will help managers to plan their ERP adoption strategy and identify the strengths, weaknesses, opportunities and threats of investing in ERP systems (Shiau et al., 2009; Woo, 2007).

The insignificant relationship found between information quality and competitive advantage indicates that the information output from ERP may not automatically lead to the creation of differential value. This means that organisations should focus on the creative use of information output to create and deliver value.

The research contributes to the literature by highlighting the importance of the direct influence of a set of antecedent factors at the adoption stage, to which managers should attend to gain competitive advantage from ERP. Building on earlier work by Grabski and Leech (2007), we recommend that managers should aim to benefit from the possible complementarities among various antecedent factors for the adoption stage in planning their ERP projects. We further discuss our research findings in detail below.

7.1 Effect of perceived system quality on competitive advantage

The modelling results show that system quality is a significant predictor of competitive advantage in ERP projects. Of all five antecedents tested in this study, it has the greatest affect (β=0.3182, p <0.01) on competitive advantage. While prior research has established the role of system quality on organisational performance effect (Chien and Tsaur, 2007), we have extended knowledge on the role of system quality in achieving competitive advantage.

Our findings suggest that good system quality is a prerequisite to the creation of differential capabilities. This is plausible because a quality system that is less prone to errors, easy to use, facilitates seamless connectivity with other systems within and outside organisational boundaries and is flexible will be expected to promote efficient utilisation and creative use of the system. In turn, this will help in building efficiencies and intellectual capital that will be difficult for competitors to imitate. Further, a good quality ERP system will facilitate stronger and profitable partnerships with supply chain partners, support achieving brand distinguishability and product and service diversity by inducing innovation to stay competitive in the market (see Table 2).

As ERP systems are generally bought off-the-shelf, rendering any changes to the system a counter-productive and costly exercise, the results of this study underline the need for careful consideration of system quality attributes for gaining competitive advantage.

7.2 Effect of perceived information quality on competitive advantage

We find that information quality is not a significant predictor of competitive advantage, which is a somewhat unexpected result. Prior studies (Gorla et al., 2010) have claimed that information quality has a significant positive influence on organisational impact.
The results suggest that ERP's ability to produce accurate, up-to-date information and well-formatted (see Table 2) information may not necessarily translate into differential benefits. It may be that creative use of information is crucial to creation of any differential values, rather than simply the information output from the system. Another possible reason is the commonality of the system's information output, which creates difficulty in gaining competitive advantage

unless information is used in a way that creates competitive advantage. The growing maturity of ERP systems could also be another reason for production of a consistent level of information quality for the adopting organisations, which does not lead to any unique benefits.

Given the results, it is plausible to suggest that managers would need to focus on how information is used and reinvented to create any distinctive advantage. This could also mean implementing protocols and user guidelines about the type, details and quality of information that is to be first inputted or fed to the ERP system so that the information output can be used for profitable purposes.

7.3 Effect of organisational readiness on competitive advantage

The results show that organisational readiness is a significant predictor for achieving competitive advantage in ERP projects. This finding is expected. An organisation's capabilities to install, operate and maintain an ERP system efficiently is expected to promote system utilisation that could lead to differential advantages.

Organisational readiness has been found a significant contributor to post-implementation success of ERP (Zhu et al., 2010). This study has extended knowledge about the role of organisational readiness in contributing to achievement of competitive advantage.

The findings confirm that focusing on development of staff skills, having good experience with network-based applications and having an enterprise-wide information sharing culture facilitate competitive advantage (see Table 2). The review of item loadings (see Table 2) confirm that staff with well-developed IT skills would be vital in maintenance and use of ERP and facilitation of operational and performance efficiencies in areas such as speed of transactions, improved management of supply chains, increased market share and improved returns on investments. Having a well-computerised and networked infrastructure will allow smooth operation and integration of ERP within organisational structure. It is expected that such integration will lead to a culture of creativity and growth, facilitating product and service differentiation, brand distinguishability and ability to respond faster to market and customer changes (see Table 2).

We propose that managers should focus on building internal capabilities and creating the foundation for ERP adoption, as such a foundation is crucial for achieving competitive advantage. Policies and programmes aimed at embracing appropriate technological advancements and upgrading technical infrastructure and staff skills could help lay the foundation for ERP installation and assist in gaining differential benefits after ERP adoption.

7.4 Effect of environmental assessment on competitive advantage

The direct and positive effect of environmental assessment on achievement of competitive advantage signifies the importance of assessing the environment in which the organisation exists (see Table 4). The environment comprises of, but is not limited to, competitors, customers, regulators, partners, other relevant stakeholders and their activities resulting in opportunities or threats for the participants (Liang et al., 2007).

Prior studies have found that consistency of internal and external factors, such as vendor support and consultant competence, influence decision making and control, efficiency and profitability significantly (Wang et al., 2008). Our current study extends this by establishing the role of the environment in the achievement of competitive advantage in ERP projects empirically. This result is expected because an understanding of competitor heterogeneity, the diversity of customers buying habits, product and service differentiation requirements and product and service pricing structures are likely to provide important information for organisations to plan and strategise to achieve differential benefits after ERP adoption. An environmental assessment will enable organisations to achieve brand distinguishing abilities and provision of customised products by identifying and planning for gaps and opportunities for: extension of products and services, enhancement of product and service features, creation of new products and product lines, cessation of mature and declining products and services and identification of new and untapped customer markets.

The findings show that managers should endeavour to play an active role in ERP planning and business case development and ensure they seek a good understanding of various market players

and their activities at the ERP adoption stage. This information should then be interpreted to create products, services and market and customer strategies that could help in achievement of competitive advantage. Early identification of gaps, opportunities and threats will be important for implementing necessary strategies for differential growth, as evidenced by the results of this study.

7.5 Effect of perceived strategic value on competitive advantage

The results show that gaining an understanding of the strategic value of ERP adoption is a predictor of achieving competitive advantage. To the best of our knowledge, no prior studies have examined the influence of desired strategic value on competitive advantage and, as such, this study has provided new evidence of such a relationship.

The results imply that an understanding of the desired or PSV in terms of reduction in costs, improved customer service and improved operational managerial efficiencies is crucial for achieving competitive differentiation (see Table 2). An understanding of the desired strategic value is expected to help in focusing on areas that could produce such value. Managers will also be able to provide leadership, resources and appropriate support.

8. Research Contributions, Limitations and Future Directions

This study makes five principal contributions in terms of helping the development of theory on how antecedent factors can be related to the competitive advantage derived from an ERP Project. Firstly, while prior research on ERP has emphasized attending to factors considered critical to the success of the implementation stage to gain the benefits of investments in ERP, this study has shown that this may not be sufficient. Our study has established empirically that, in fact, certain of the antecedent factors to the adoption of an ERP project can have a significant influence on the process of deriving competitive advantage for an organization, which was not known before.

Secondly, this study has shown that the early assessment of the following factors at the ERP adoption stage is vital to judge the likely capability of achieving competitive advantage: system

quality, organisational readiness, environmental assessment and the assessment of strategic value. If one of these factors is assessed as being inadequate then it can be brought to management attention at the ERP adoption stage and addressed so that it will not hold back the achievement of competitive advantage.

Thirdly, the study has established that antecedent factors to successful ERP adoption can also have further influences; that is, they are not only critical to the success of the adoption stage in the ERP deployment process but their influence can extend beyond that in helping to achieve differential benefits and values that contribute to competitive advantage.

Fourthly, the study has identified a set of antecedent factors that, collectively, have significant bearing on the achievement of competitive advantage from ERP projects. Finally, the study provides findings and a methodology that can be built upon in future research to establish the effects of further antecedent factors, like top management support, charismatic leadership, and project champion, to name a few, on the achievement of competitive advantage.

The outcomes of the study have several implications for practitioners. For example, as the results imply that system quality has the greatest bearing on the competitive advantage of a company investing in an ERP project it is what ERP software developers should focus upon most. The study also identifies for a company's management, who may be contemplating investment in ERP, what factors need to be appraised beforehand for their inclusion in operational plans and strategies so as to gain the long-term benefits, like competitive advantage, from the investment. The factors that our study identified that require this prior assessment and good understanding of were: the ERP's system attributes, the internal and external organisational environment and the desired benefits and strategic values sought from it. Managers need to gain information from various sources on these factors in their ERP project planning and include not only vendor recommended sources but draw from their personal networks to help work towards ultimately achieving competitive advantage (Table 2).

To build upon our initial work in this area further studies should be done to investigate the influence of other antecedent factors on competitive advantage, such as competence of ERP

consultants, having a good steering committee, and careful selection of ERP package. We examined factors that influence the adoption stage of ERP and also contribute to competitive advantage from it. It would be potentially useful to examine the factors that influence the achievement of other stages of the ERP deployment process, like implementation, and use, to identify which of those have influence upon subsequent competitive advantage, too. Our examination of factors that need assessment at the adoption stage of ERP in order to help achieve competitive advantage prompts the question about the sustainability of competitive advantage. A further opportunity for research, therefore, could be to conduct a longitudinal study to investigate the sustainability of competitive advantage gained by organisations after adopting ERP.

One of the limitations of our study is that it is based upon cross-sectional data at one point in time that indicates the apparent influence of certain factors on competitive advantage from ERP projects. To further establish our findings, longitudinal studies could be done using our methodology and/or similar studies could be undertaken in other countries to see if our findings are replicated. A further limitation is that the data for our study were collected in a country which can be considered a technologically advanced one and so our findings should be applied with caution in industry environments with less advanced technological infrastructures.

9. Conclusion

This study developed and established empirically that a number of antecedent factors considered critical to the adoption stage of ERP can also be key drivers for the achievement of competitive advantage. The results show that an assessment and understanding of system quality, organisational readiness, business environment and assessment of the strategic value of adopting ERP can be crucial for generating desired competitive advantage after ERP adoption, including competitive advantage. To the best of our knowledge, no previous study has investigated how factors, identified to be critical to the adoption stage of ERP, can also influence the achievement of competitive advantage from them.. One of the key contributions of the study is that it has empirically identified a set of antecedent factors that can collectively and substantially, (R^2 = 32.23 per cent) lead to achievement of competitive advantage in ERP projects. Such an understanding can enable managers to concentrate on a set of complementary factors for achieving value from investments in ERP projects. The substantially large GoF value of 41.1 per

cent for the empirically validated model demonstrates the robustness of the findings of this study.

Previous research into ERP systems has generally focused on developing an understanding of the capabilities that can help generate competitive advantage. We have added a further perspective of how an organization can influence the achievement of competitive advantage through careful management of antecedent factors at the adoption stage of ERP. While organizations are introducing ERP systems to streamline their operations, and gain long-term competitive benefits, we have shown the impact of certain antecedent factors on producing some of the usually required benefits.

Our results indicate that taking care to assess certain factors very carefully prior to managing the adoption stage of ERP could be vital to more fully reap the rewards of investments in ERP systems.

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Appendix A: Tables

Table 1: Respondents Profile

	Frequency	Per cent (%)	Cumulative (%
Type of ERP			
SAP, Oracle, PeopleSoft, JD Edwards	99	45.62	45.62
BAAN, Pronto, QAD, MS Dynamics	42	19.35	64.98
Epicor, Ellipse, Civica, BPCS, SunSystems, etc.	33	15.21	80.18
Others	43	19.82	100.00
Year of ERP Implementation			
2007–2009	43	19.82	19.82
2001−2006	101	46.54	66.36
2000 and before	45	20.74	87.10
Others	28	12.90	100.00
Organisational Size			
Large	154	70.97	70.97
Medium	52	23.96	94.93
Small	11	5.07	100.00
Type of Industry			
Public Sector, Utilities, etc.	65	29.95	29.95
Healthcare, Pharmaceuticals and Miscellaneous	38	17.51	47.47
Manufacturing, Mining, Automotive	35	16.13	63.59
Higher Education & Research, Professional Services	28	12.90	76.50
Wholesale, Retail, Consumer Products	28	12.90	89.40
High-tech, Aerospace & Defence, Telecommunications	23	10.60	100.00
Job Title of Respondents			
CEO, CFO, COO, MD, GM	56	25.81	25.81
CIO, CTO, IS/IT Mgr, Technology Director, VP IT	112	51.61	77.42
Business Manager, Director, DM, FM, PM	32	14.75	92.17
Others	17	7.83	100.00

Table 2: Results of the Analysis of the Measurement Model

	No of. Items	AVE	CR	Cronbachs Alpha	Correlations (Square root of AVEs in the diagonal)					
					CADV	EVA	OGRD	PIQ	PSQ	PSV
Competitive Advantage (CADV)	**7**	0.5341	0.8890	0.8432	**0.7308**					
Environmental Assessment (EVA)	**5**	0.5279	0.8469	0.7762	0.2570	**0.7266**				
Organisational Readiness (OGRD)	**4**	0.5554	0.8329	0.7133	0.3234	0.1218	**0.7453**			
Perceived Information Quality (PIQ)	**4**	0.5052	0.8028	0.6677	0.3124	0.0516	0.3454	**0.7108**		
Perceived System Quality (PSQ)	**4**	0.5050	0.8015	0.6654	0.4454	0.0396	0.2814	0.5679	**0.7106**	
Perceived Strategic Value (PSV)	**6**	0.5208	0.8668	0.8150	0.3873	0.1297	0.2345	0.3611	0.3824	**0.7217**

The diagonal elements are the square root of average variance extracted (AVE)

CR = Composite reliability

			Standardised factor loadings (with *p* -values)							
Items	**Mean**	**St.Dev.**	**CADV**	**EVA**	**OGRD**	**PIQ**	**PSQ**	**PSV**		***p* -values (2-tailed)**
cadv2: supply chain efficiency	3.45	0.95	0.7224							< 0.001
cadv3: customised products/services	3.12	0.91	0.7134							< 0.001
cadv4: Speed-up transaction	3.80	0.80	0.6747							< 0.001
cadv5: enhance brand distinguish-ability	2.75	0.81	0.7565							< 0.001
cadv6: increase market share	2.78	0.79	0.7809							< 0.001
cadv7: increase return on investments	3.22	0.80	0.7402							< 0.001
cadv10: respond more quickly to changes	3.40	0.95	0.7232							< 0.001
eva2: unpredictability of competitors	2.76	0.81		0.5883						< 0.001
eva3: diversity of customer buying habits	3.06	0.96		0.7888						< 0.001
eva4: diversity of product line	3.06	1.07		0.7291						< 0.001
eva5: tough price competition	2.90	1.04		0.7097						< 0.001
eva6: competition in product/service differentiation	3.00	1.06		0.7974						< 0.001
ogrd2: Employees' IT skills	2.91	1.07			0.7079					< 0.001
ogrd3: Experience with network-based applications	3.69	0.89			0.8010					< 0.001
ogrd4: Networked infrastructure	4.03	0.76			0.7535					< 0.001
ogrd5: enterprise-wide information sharing	3.30	1.00			0.7150					< 0.001
piq1: Completeness of information	3.20	0.89				0.7039				< 0.001
piq2: Accurate information	3.80	0.72				0.7316				< 0.001
piq3: Consistent format of information	3.93	0.67				0.6480				< 0.001
piq4: Up-to-date information	3.57	0.87				0.7551				< 0.001
psq2: Flexibility	3.44	0.87					0.6705			< 0.001
psq3: Integration capabilities	4.01	0.87					0.6218			< 0.001
psq4: Easy to access	3.75	0.79					0.8166			< 0.001
psq5: Timely information provision	3.93	0.70					0.7190			< 0.001
psv1: reduce cost of business operations	3.85	0.74						0.6520		< 0.001
psv2: improved customer service	3.97	0.64						0.7073		< 0.001
psv3: effective support for operations	4.15	0.59						0.7313		< 0.001
psv4: mangers with better access to information	4.20	0.63						0.7272		< 0.001
psv5: improved productivity of managers	3.86	0.67						0.7401		< 0.001
psv6: information to support strategic decision-making	4.15	0.65						0.7669		< 0.001

** All standardized factor loadings are significant at $p < 0.001$

Table 3: Cross Loadings of the Constructs

	CADV	EVA	OGRD	PIQ	PSQ	PSV
cadv2	0.7224	0.2596	0.2937	0.2455	0.3627	0.2737
cadv3	0.7134	0.2690	0.2001	0.0905	0.2137	0.1701
cadv4	0.6747	0.0138	0.2730	0.2230	0.3424	0.2680
cadv5	0.7565	0.2307	0.2075	0.1703	0.2280	0.2800
cadv6	0.7809	0.3391	0.1779	0.1985	0.2337	0.3130
cadv7	0.7402	0.1667	0.1542	0.2791	0.3347	0.2914
cadv10	0.7232	0.0558	0.3113	0.3333	0.4897	0.3480
eva2	0.1334	0.5883	0.0795	–0.0307	–0.0822	0.0479
eva3	0.2637	0.7888	0.1268	0.0173	0.0399	0.1354
eva4	0.1173	0.7291	0.0999	0.0518	0.0624	0.0673
eva5	0.1514	0.7097	0.0587	0.1019	0.1012	0.0846
eva6	0.2008	0.7974	0.0660	0.0549	0.0157	0.1005
ogrd2	0.2483	0.1303	0.7079	0.3598	0.2470	0.1197
ogrd3	0.2257	–0.0094	0.8010	0.1623	0.1447	0.1889
ogrd4	0.2395	0.0430	0.7535	0.1928	0.2021	0.2209
ogrd5	0.2463	0.1881	0.7150	0.3012	0.2365	0.1704
piq1	0.2631	0.0494	0.2922	0.7039	0.4077	0.1474
piq2	0.2065	0.0418	0.2326	0.7316	0.3630	0.3005
piq3	0.1981	–0.0295	0.2447	0.6480	0.4219	0.3634
piq4	0.2073	0.0784	0.1985	0.7551	0.4195	0.2484
psq2	0.3470	0.0449	0.2151	0.2730	0.6705	0.2197
psq3	0.2486	–0.0156	0.2058	0.3671	0.6218	0.3027
psq4	0.3466	–0.0017	0.1615	0.4381	0.8166	0.2484
psq5	0.3078	0.0786	0.2245	0.5473	0.7190	0.3359
psv1	0.3079	0.1260	0.1349	0.1245	0.1260	0.6520
psv2	0.3260	0.1987	0.1934	0.2348	0.2422	0.7073
psv3	0.2677	0.1238	0.3083	0.3790	0.3693	0.7313
psv4	0.2175	0.0262	0.0888	0.2843	0.3664	0.7272
psv5	0.2382	0.0292	0.1465	0.2759	0.2799	0.7401
psv6	0.2815	0.0121	0.1233	0.2886	0.3101	0.7669

Table 4: The Results of PLS Analysis

Structural paths in the model	Sign	PLS path coefficient	Standard error	*t*-statistic	*p*-value
H1: PSQ–CADV	+	β = 0.3182	0.0940	3.3864	< 0.01
H2: PIQ–CADV	-	β = -0.0094	0.0736	0.1275	ns ($p > 0.05$)
H3: OGRD–CADV	+	β = 0.1650	0.0616	2.6798	< 0.01
H4: EVA–CADV	+	β = 0.1982	0.0588	3.3697	< 0.01
H5: PSV–CADV	+	β = 0.2046	0.0794	2.5755	< 0.01

Note: Hypotheses supported: H1, H3, H4, H5; Hypothesis not supported: H2; Variance explained for CADV: R^2 = 32.23 per cent

Appendix B: Figures

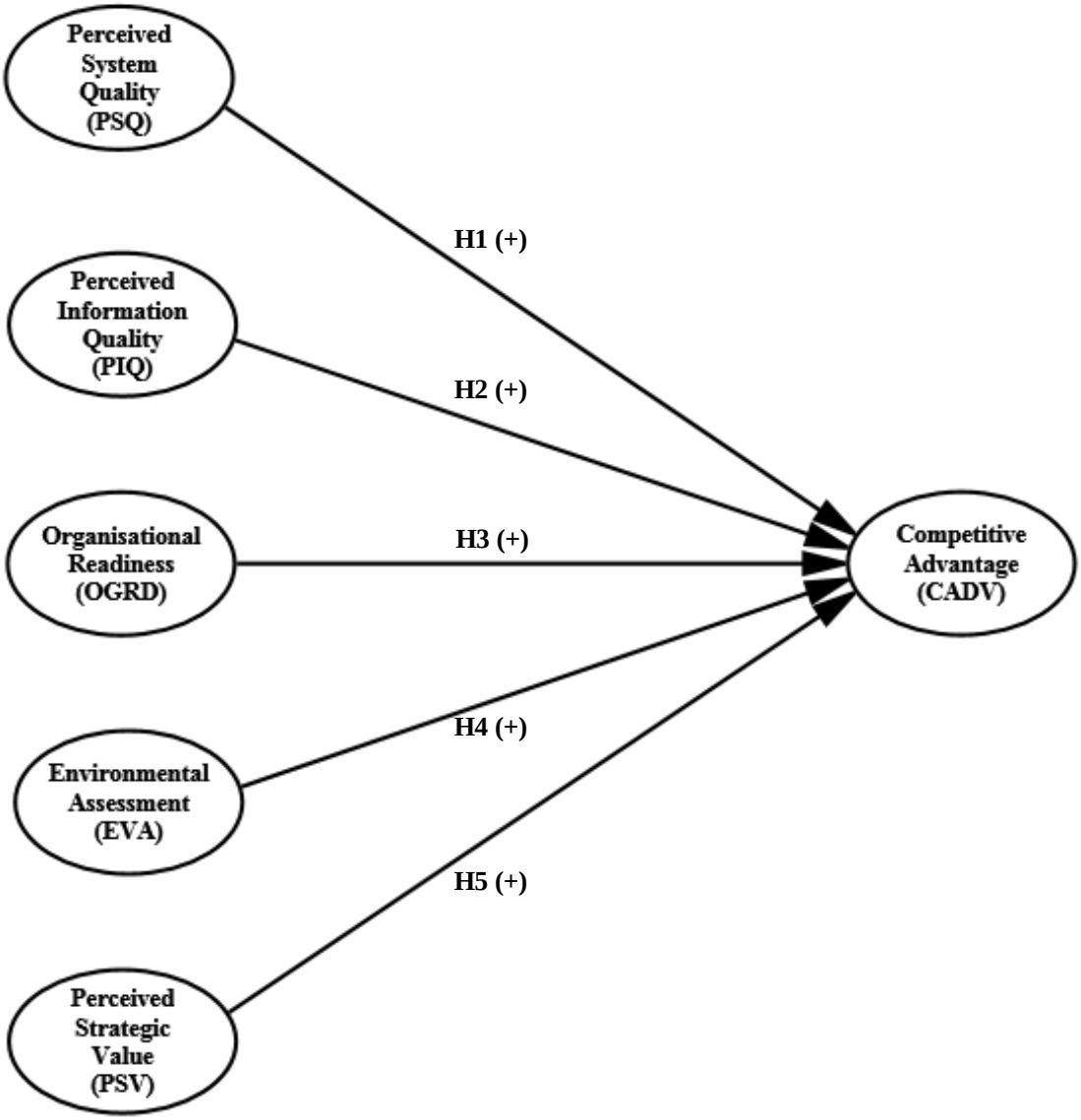
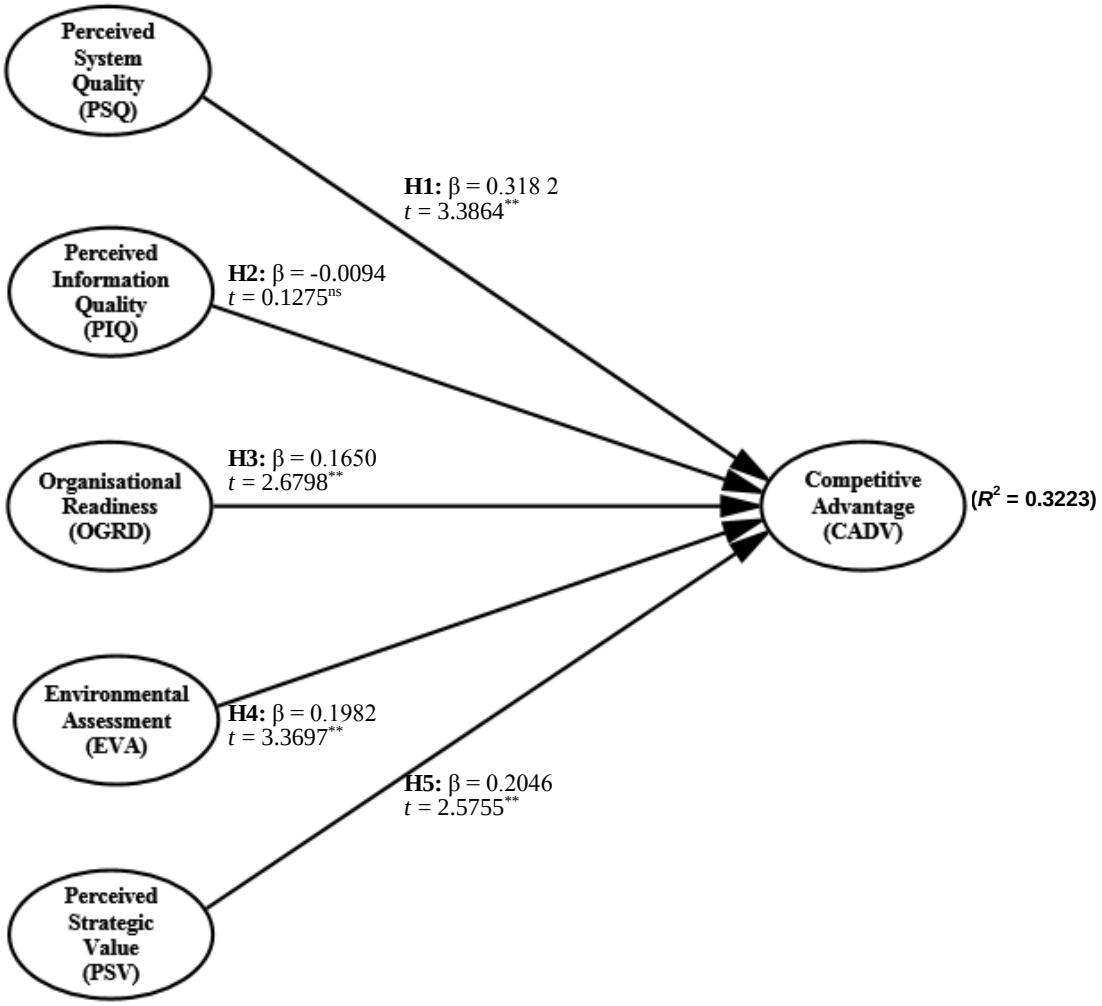


Figure 1: The Conceptual Model



** $p < 0.01$

Figure 2: The Results of PLS Paths