

Digital Transformation through Enterprise Systems: A Variance Model Linking the Drivers of Business Value and the Value Created from Enterprise Systems

(Full Paper)

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ABSTRACT

Currently, the potential of Enterprise Systems to transform organizations is emerging as a popular area of investigation. The aim of this study is to a) identify the means of such transformation or business value creation, beyond operational efficiency, that Enterprise Systems can enable and b) understand the drivers of such ES-enabled business value creation. This paper presented and found empirical support for a new model to establish relationships between the drivers of Enterprise Systems-enabled business value, and the business value created. The proposed model was empirically tested using data analysis of user cases of Enterprise Systems around the world. The study found evidence of support for both association and causality between drivers of business value (integrate, optimise and informate) and the business value created (Mergers and Acquisitions, Innovation, and Strategic Decision Making) from Enterprise Systems. This study can be treated as a foundation for further research for generalization of the proposed causal relationships between the value created by Enterprise Systems and the drivers of such value using detailed case studies, and uncovering more such causal relationships. The contribution of this paper is that it presents and empirically tests a new variance model that establishes causal relationships between drivers of business value from Enterprise Systems (integrate, optimise and informate) and the business value created (Mergers and Acquisitions, Innovation, and Strategic Decision Making).

Keywords: Enterprise Systems, Business Value, Innovation, Mergers and Acquisitions, Strategic Decision Making.

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INTRODUCTION

Information Technology has become an integral and indispensable part of the world of business and commerce. In the past few decades, a variant of such technology, called 'Enterprise Systems', has become widely popular with large organizations, and increasingly so with small to medium-scale businesses. Enterprise Systems (ES) can be defined as large-scale, packaged, application software systems that can be used to streamline and integrate the business processes of an organization, and considerably improve information and knowledge levels within the organization as well as with its customers and suppliers (Davenport 2000). In modern times, ES has become a generic term that includes a number of systems like Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supplier Relationship Management (SRM), Supply Chain Management (SCM) and so on.

This brings us to the fundamental questions of business organizations - 'Is this all worth it?' or 'What is the value added?' Business organizations undertake all investments with one overarching goal in mind - business value. Value means the worth or desirability of an entity or object. The term is subjective, and depends on the context. Business Value' or the value from a business organization's perspective means maximizing shareholder returns, increasing market share, gaining goodwill in the market, expansion and growth etc. Such value can be achieved through different ways: improving efficiency of operations and cost savings thereof, innovative service, strategic positioning, improved decision making and so on (Smith and McKeen 2003). All organizations who have already implemented Enterprise Systems or are planning to do so hope to maximize their return on such enormous investments. In other words, they seek to get more out of these systems than just improving operational efficiency; they want to be able to compete better (Holland and Light 2001; Teo et. al. 2006; Ruivo et.al 2014; Sedera et al 2018; Nwankpa 2019).

Information Technology, in general, has been reported to enable business value creation above and beyond improving operational efficiency (Goldsmith 1991; Earl 1993; Sambamurthy and Zmud 1994; Barrett and Walsham 1995; Parker 1996; Weill and Broadbent 1998; Sawy et.al. 1999; Rai et al 2006; Weill and Ross 2009). Furthermore, IT has been widely argued to have a strategic potential – the ability to support organizations to compete better in the market. The Resource-Based View (RBV) of the firm, one of the most useful and powerful theories for studying organizations (Kraaijenbrink et al. 2010), has been used to understand the potential of IT to create competitive advantage by several researchers, e.g., Mata et. al (1995), Wade and Hulland (2004), Piccoli and Ives (2005), Nevo and Wade (2010). They all argue that IT has 'strategic' potential when it is combined with other organizational resources to develop 'IT-enabled' resources. Recently, Sedera et al. (2016) did a study involving 189 organizations and concluded that ES platform has a significant and positive impact on innovation.

With Enterprise Systems as the preferred IT platform, exploiting such systems to compete better in the market has become a trend in the corporate world. Large, multi-national, 'IT consulting' organizations are now claiming to implement and harness

these systems to enable value, beyond operational efficiency, for their clients. Further, all the vendors of Enterprise Systems claim to enhance and equip their software to play a 'strategic' role to enable the adopting organizations to compete stronger in the market (Seddon 2005; Ruivo et al 2014; Rouhani & Mehri 2018; See, Yap & Ahmad 2019).

But despite these claims by vendors and consultants, there is very limited empirical research that explores the drivers of business value creation beyond improving operations using Enterprise Systems. So there exists an opportunity to look at the strategic potential of Enterprise Systems - the contribution of such systems in enabling business value in addition to improving operations of the adopting organizations.

In particular, there is a gap in research so far on the causal links between the individual drivers of ES-enabled business value and the different means of business value created by Enterprise Systems. The novelty of this paper is that it seeks to explore the unexplored area of the causal relationships between drivers of business value and the types of business value created by Enterprise Systems. This leads to the research question:

How is business value creation, beyond operational efficiency, driven from Enterprise Systems?

DRIVING ENTERPRISE SYSTEMS-ENABLED BUSINESS VALUE BEYOND OPERATIONAL EFFICIENCY: A REVIEW OF THE LITERATURE

Firstly, it should be noted here that for this research, we are interested in the ES-enabled business value creation beyond operational efficiency in the long run. It has been found by many studies that organizations have adopted Enterprise Systems and benefitted significantly from the operational efficiency they provide in the form of less errors, faster data entry, better monitoring of operations and others (Sumner 1999; Shang and Seddon 2002; Spathis and Constantinides 2003; Davenport 2004; Motiwalla and Thompson 2009; Seddon et al. 2010; Rouhani & Mehri 2018). But the motivation for the study is to go beyond the operational benefits of Enterprise Systems and explore how these systems can enable business value beyond operational efficiency.

A systematic review of the literature on Enterprise Systems revealed three commonly mentioned means (in addition to improving operations) by which Enterprise Systems can enable business value through:

- a) Mergers and Acquisitions, as suggested by Gupta (2000), Grainger (2007), Mehta and Hirschheim (2007), and Weill and Ross (2009), Hedman and Sarker (2015), and Henningson et al. (2018).
- b) Innovation, as suggested by Rajagopal (2002), Bradford (2003), Swanson and Pang (2005) and King (2006) and Srivardhana (2007), Romero and Vernadat (2016), Lasisi et al (2017), Boscoianu et al. (2018).
- c) Strategic decision-making, as suggested by Bligh and Turk (2004), Spathis and Constantinides (2004), Rom and Rohde (2006), Goodhue et. al (2002), Rigby and Ledingham (2004), Teittinen et. al (2013), Romero and Vernadat (2016), Heidary et al. (2018), Holsapple, Sena and Wagner (2019)

The systematic literature review conducted by the author to arrive at the above-mentioned 3 means is explained as follows. Given that Enterprise Systems were initially developed to provide operational efficiency, and are only recently being looked at for other ways of creating business value, there isn't much prior research in this area. Therefore, a detailed systematic review of literature was done to identify means (in addition to operational efficiency) in which IT, in general, can enable business value. Such a review (as summarized in the Table 1) supported two common means through which IT enables business value: a) innovation- new products/services and new processes and b) strategic decision making.

Table 1: A systematic review of studies showing the key means of business value created by IT

Study	Means of Creating Business value with IT	IT Supports Innovation?	IT Supports Strategic Decision Making ?
Sambamurthy and Zmud (1994)	-New Products and Services -Transformed Processes -Enriched Organizational Intelligence	Yes, in -New Products and Services -Transformed Processes	Yes, in -Enriched Organizational Intelligence
Mooney et al. (1996)	-Automational -Informational -Transformational	Yes, in -Transformational	Yes, in -Informational
Weill and Broadbent (1998)	-Infrastructural -Transactional -Informational -Strategic	Yes, in -Strategic	Yes, in -Informational
Tallon et al. (2000)	-Customer relations -Supplier relations -Sales and Marketing -Productions/operations -Product/service enhancements -Process planning and support	Yes, in -Product/service enhancements -Productions/operations	Yes, in -Process planning and support
Applegate et al.(2003)	-Assist auxiliary support -Support core processes -Support strategy of the firm -Innovate	Yes, in -Innovate	Yes, in -Support strategy of the firm
Sambamurthy et al. (2003)	-Agility -Digital options -Entrepreneurial alertness	Yes, in -Agility -Digital options	Yes, in -Entrepreneurial alertness
Kohli and Grover (2008)	-Co-creating with partner organizations -Embedding IT into processes -Reassessing and making decisions by information analysis	Yes, in -Embedding IT into processes	Yes, in -Reassessing and making decisions by information analysis
Weill and Ross (2009)	-Operational performance improvements -Acceleration product/service innovation -Reorganization around customer-oriented processes -Integration of Mergers and Acquisitions	Yes, in -Acceleration product/service innovation	Yes, in -Reorganization around customer-oriented processes

Source: This Study

It may be noted that support for Mergers and Acquisitions as a means of creating value with IT was found in the study by Weill and Ross (2009) only. However, enabling Mergers and Acquisitions seems especially important in the case of Enterprise Systems, as a specialized variant of IT, as suggested by Gupta (2000), Grainger (2007), Mehta and Hirschheim (2007), Weill and Ross (2009), Motiwalla and Thomson (2009) and Henningsson et al. (2018). So this means was added as a key means of creating business value with Enterprise Systems.

Next, authors like Rajagopal (2002), Bradford (2003), Swanson and Pang (2005) and King (2006) have suggested the concept of innovating with Enterprise Systems. However, they study the implementation of such systems as an innovation by itself; they have not said much to address the new opportunities these systems can create through new products and processes. Shang and Seddon (2002) in their classification of the benefits derived from Enterprise Systems have mentioned building business innovations and generating product differentiation as benefits in the 'Strategic' category. However, this has not been discussed to much depth. Srivardhana (2007) studied how Enterprise Systems can enable innovation and found that these systems can both enable and hinder process innovation - a rather interesting finding. So there is an opportunity to explore this phenomenon further (Boscoianu et al., 2018).

Finally, researchers have also begun to explore the role of Enterprise Systems in strategic decision making. Davenport (2000) suggests that the key strategic areas in which Enterprise Systems can play an important role are the sense-and-respond business

models, globalization and in extending the value chain. Goodhue et al. (2002), Bligh and Turk (2004), and Rigby and Ledingham (2004) suggest that CRM systems have strong strategic potential for increasing market share by using them to manage customers through better promotion of products/services, better customer service and better identification of profitable customers. A survey revealed that ERP systems enable profitability analysis by business segments; this analysis assists in strategic decision making by top management members (Spathis and Constantinides 2004). The Data Warehouse and Business Intelligence technologies translate the business strategy into Key Performance Indicators and analyze them to reveal how the organization is performing (Bose 2006; Heidary et al. 2018; Holsapple, Sena and Wagner 2019).

Having reviewed the means of creating business value beyond operational efficiency, it is now useful to look at the drivers that drive such business value from Enterprise Systems. A review of the literature shows that there is little research that deals with the drivers through which Enterprise Systems can enable mergers and acquisitions, innovation, and strategic decision making—the key interest for this research. The best known studies are the ones that discuss the drivers of Enterprise Systems-enabled benefits in general. Kennerley and Neely (2001) said that better information availability and better designed business processes are the ingredients to realizing organizational benefits from Enterprise Systems. Davenport et al. (2004) have suggested that organizations achieve business benefits from Enterprise Systems by integrating data and systems, optimizing business processes and accessing and analyzing real-time information. Gattiker and Goodhue (2005) propose the drivers of benefits as data quality, task efficiency, and coordination improvements. Davenport et al.'s (2004) long-term benefit drivers (integration, process improvement, and informing) map very well to Gattiker and Goodhue's model: the 'interdependence–coordination–improvement' link indicates integration, 'task efficiency' implies process optimization, and 'data quality' implies benefits from improved access to information. Seddon et al. (2010), in their 'OBES' model, reinforced the three factors that Davenport proposed – integration, process optimization and informing. Therefore, the key drivers of Enterprise Systems-enabled business value identified from the literature are (a) integrating, (b) optimising and (c) informing.

Furthermore, a few attempts have been made to find causal relationships between (a) drivers of value and (b) the business value created by Enterprise Systems. Davenport et al.'s (2004) study demonstrates association using correlation figures which are moderately positive in all cases. For example, a correlation coefficient of 0.19 between the constructs 'Integrate' and 'Benefits Realized' indicates an association between these two constructs. In other words, within the sample studied, on average, the more the organizations integrated using Enterprise Systems, the more benefits they realized. As an extension / reconfirmation of the study on the drivers of business benefits from ES by Davenport et al. (2004) discussed in detail earlier. Seddon et al. (2010) proposed a long-term, multi-project model listing factors that drive organizational benefits from Enterprise Systems. The model suggests that in the short-term, two factors, namely 'functional fit' and 'overcoming organizational inertia', drive organizational benefits from the different ES projects. Also, the model suggests that in the long-term, four factors, namely 'integration', 'process optimization', 'improved access to information', and 'on-going ES business improvement projects', drive benefits from Enterprise Systems. This study is a synthesis of project-based studies around Enterprise Systems and the long-term benefits derived from such systems. However, this study also does not delve into much detail about the different types of benefits that these organizations realize.

It is evident that neither Davenport nor Seddon attempt to link the drivers of benefits to any particular types of benefits or business value. So, these studies refer to benefits or business value in general and have not proposed any drivers of value to enable business value through specific means. In other words, the drivers of Enterprise Systems-enabled benefits identified are for benefits in general, not for any particular kind of benefit. Therefore, there exists a gap in literature which is intended to be addressed by this paper. The pages below attempt to do this by formulating, discussing and justifying four hypotheses (marked by arrows in the Figure 1), based on logic and evidence from past studies. These hypotheses are also tested empirically later in this paper.

TOWARDS A NEW MODEL: LINKING DRIVERS OF ES-ENABLED BUSINESS VALUE TO THE BUSINESS VALUE CREATED

As established in the previous section, Enterprise Systems have the potential to deliver business value above and beyond operational efficiency, mainly through the means of enabling (a) mergers and acquisitions, (b) innovation and (c) strategic decision making. It was also established that the key drivers of Enterprise Systems-enabled business value identified are (a) integrating, (b) optimising and (c) informing. The two tables below define and explain each of these concepts.

Table 2. Drivers of Business value with Enterprise Systems (based on Davenport et al. 2004)

Construct	Meaning
Integrate	'harmonize the data, processes and systems within the organization as well as beyond the boundaries, extending to customers, suppliers and other stakeholders'
Optimize	'standardize the processes (both front-end/customer facing and back end/administrative) by aligning them with best practices or modify/enhance processes to meet the strategic needs of the organizations that yield competitive advantage'
Informate	'provide access to real time data and the capability to analyze the internal organizational performance and the behaviour of external stakeholders like customers and suppliers'

Source: This Study

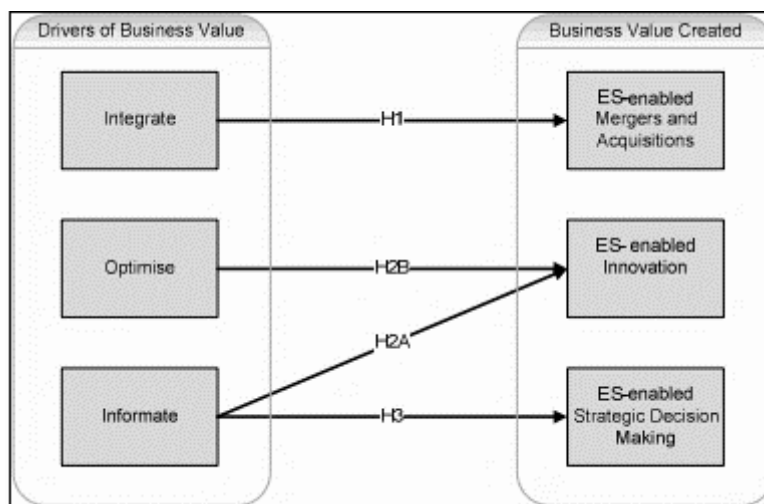
Table 3. Business Value Created using Enterprise Systems (based on Weill and Ross 2009)

Construct	Meaning
Mergers and Acquisitions	Mergers and acquisitions (M&A) occur when two or more organizations join all or part of their operations. The businesses of both organizations are brought together as one (Doyle 2000). They help a business entity grow rapidly in either a) its sector or location of origin, or b) a new field or new location, thus achieving inorganic growth.
Innovation	Innovation adds unique value for the customers, enables competitive advantage and generates value for shareholders (Drucker 1985, Snyder and Duarte 2003). The dimensions along which an organization can undertake innovation are product and process (King et al. 1994; Christensen 1995; O'Sullivan and Dooley 2009). Product Innovation: Product innovation can be said to be the development of new products, changes in design of established products, over time (Dougherty and Hardy 1996) Process Innovation: Process innovation is 'the critical analysis and radical redesign of work flows and business processes to achieve dramatic improvements in important measures of performance' (Martinsons 1995 p.254)
Strategic Decision Making	Strategic decision making involves making 'intentional choices or programmed responses about issues that materially affect the survival prospects, well-being and nature of the organization' (Schoemaker 1993 p.107).

Source: This Study

The motivation of this paper is to establish relationships between the drivers of Enterprise Systems-enabled business value, (i.e., Integrate, Optimize, Informate) and the business value created (Mergers and Acquisitions, Innovation and Strategic Decision Making). As established earlier and to the best of the author's knowledge, there is a gap in research so far on the causal links between the individual drivers of ES-enabled business value (i.e., Integrate, Optimize, Informate) and the different means of business value created. So a new Variance Model is proposed to address this gap.

Variance models are based on the assumption that variation in predictors or independent variables is responsible for variation in outcomes or dependent variables. (Mohr 1982; Van de Ven and Huber 1990; Newman and Robey 1992, Wynn and Williams 2012). The proposed Variance Model takes a step further by attempting to link these three drivers to the particular means of business value creation: an aspect missing in the work of both Davenport and Seddon.



Source: This Study

Figure 1: A Variance Model to show the relationship of the drivers of business value and the business value created

The purpose of this section is to present and discuss this new Variance Model shown in Figure 1. The constructs (denoted by the boxes) of the model are defined in the Tables 2 and 3 and the hypotheses (denoted by the arrows) embedded in the model are explained in the following sections.

‘Integrate’ Facilitates ‘Mergers and Acquisitions’

Firstly, as stated in Hypothesis H1 in the Figure 1, it is argued that Mergers and Acquisitions are facilitated by employing the ES to ‘integrate’. IT-based systems are a key component in the integration phase of the merger and acquisition process (Galpin and Herndon 2007; Mehta and Hirschheim 2007). A major problem in post-acquisition integration of mergers and acquisition is to combine a plethora of isolated systems of the two (or more) organizations. This means that the greater the number of systems in each merging organization, the more difficulty the merged entity would experience in merging systems. It has been found that integration of disparate systems in an organization is a cumbersome task and the ES should be employed to integrate several systems into one integrated platform. Therefore, having an ES in place usually means that the organization has an integrated system platform already in place.

Enterprise Systems by definition are integrated systems, i.e. different systems components like finance, HR, operations are logically integrated into a single system. When an organization undertakes a Mergers and Acquisitions initiative, having integrated systems such as ERP Systems in place helps to smoothen out the process of integrating the systems of the two (or more) organizations, which is one of the most complex, time-consuming, error-prone, and expensive tasks involved in Mergers and Acquisitions. With Enterprise Systems in place, the acquiring organization needs to integrate one or more systems of the acquired organization(s) into the one single system of its own during the ‘post-acquisition integration’ phase of a merger of two or more organizations. ERP systems adopted by manufacturer firms have been reported to assist in quickly integrating systems following mergers and acquisitions in prior studies (Gupta 2000; Grainger 2007; Bourgeois III et al. 2017; Henningson et al 2018). For example, Danisco, a global food ingredients organization built its ‘growth-by-acquisition’ strategy based on its SAP ERP and CRM platform, which it used to integrate its acquiring organizations into (Yetton et al. 2013). Furthermore, if the acquired organizations have integrated Enterprise Systems themselves, this may further assist the M&A initiative, given the even lower number of systems to integrate (Henningson et al. (2018).

The above section suggests that a high degree or extent of integration of systems, data and processes within the organizations prior to takeover supports their IT-systems-merger initiatives (if these are thought desirable). This insight can be summarized as:

Hypothesis 1: The more the acquiring organizations employ their Enterprise Systems to integrate processes and data, the easier it is for them to undertake mergers and acquisitions

‘Informate’ Facilitates ‘Innovation’

Secondly, it is argued that Innovation is facilitated by employing the ES to a) ‘informate’ as well as b) ‘optimise’. As stated in Hypothesis H2A, ‘Informating’ enables insight to information about customer needs, thus being able to identify gaps between what customers want and what products/services are offered. This information forms the basis of the ‘idea generation’ activity of undertaking innovation, as suggested by Tushman (1977). An example is the use of customer interaction information from CRM systems to understand the needs of customers from the nature of their requests and complaints. This will assist the organization to launch a new product or a service that customers appreciate. For example, in a CRM context, identifying what, when, where in terms of past customer interactions could reveal more insight into exact customer needs (Bligh and Turk 2004). This can be done by analyzing the integrated information in the ES using the analysis tools (like OLAP and data mining) provided by the ES. In turn, this could trigger new product innovation. (Romero and Vernadat 2016). Often, new services are delivered through the ES, or using the ES as a back-end. For example, it is possible to offer a new service by integrating the organization with its supply-chain partners. UPS, the parcel delivery giant, implemented Oracle Enterprise Systems to provide a range of services to customers including tracking deliveries as a means of product/service differentiation (Motiwalla and Thomson 2009; Boscoianu et al. 2018). Therefore, it can be said that informing leads to innovation, leading to the hypothesis: *Hypothesis 2A: The more the adopting organizations employ their Enterprise Systems to informate, the easier it is for them to undertake innovation*

‘Optimise’ Facilitates ‘Innovation’

Again, as stated in Hypothesis H2B, it is argued that optimized processes facilitate implementing the innovation, thus facilitating the ‘implementation’ activity of innovation, as suggested by Tushman (1977). Often a new product or service is delivered electronically, and very often the ES is used to implement the service. For example, a new online parcel tracking service is offered to customers using a web-based Enterprise System. Particularly, process innovation can be accomplished by creating new processes or wholly redesigning existing processes, enabled by Enterprise Systems (Swanson and Pang 2005). ERP systems, with their built-in process modelling tools and implementation of processes, can be used for Business Process re-engineering: the foundations of process innovation. In Geneva Pharmaceuticals, business processes were categorized into supply and demand groups, and processes in each of the two groups were re-engineered and then integrated (Bhattacharjee, 1999). Again, in Textiles PLC, business processes were revamped to fit the strategy of one global organization using the Enterprise System (Holland & Light, 1999). Wipro Consulting adopted ERP to implement human resource self-service: a new model for managing their strategic resources, i.e., employees (Motiwalla and Thomson 2009). This can be in back-end

processes by using the ‘best practices’ of the Reference Models in ERP Systems or the customer-facing processes by adopting the marketing-sales-service cycle of CRM systems. Enterprise Systems assist in completely redesigning business processes or inventing new processes using their ‘optimised’ built-in best practices. These best practices are developed over the years from processes of high performance organizations in different industries (Lasisi et al 2017). So it can be argued that aligning most of the business processes of the organization to ‘best practices’ of Enterprise Systems leads to many new innovative processes being introduced into the organization. The insight above can be summarized as:

Hypothesis 2B: The more the adopting organizations employ their Enterprise Systems to optimise processes, the easier it is for them to undertake innovation

‘Informate’ Facilitates Strategic Decision Making

Thirdly, as stated in Hypothesis H3 it is argued that Strategic Decision Making is facilitated by employing the ES to ‘informate’. Exploitation of IT/IS capabilities in general to play a role in formulating business strategies was found to be useful by several researchers (Applegate et al. 1996; Goldsmith 1991; Robson 1997). Kearns and Lederer (2000) summarize such studies and propose a useful model of interaction of Information Systems Planning (ISP) and Business Strategy/Planning (BP) wherein both are shown to positively impact each other. Enterprise Systems, in particular, when used to informate using the high-quality information available and the specialized analytics capability provided with the business intelligence technologies, assist in profitability analysis (Spathis and Constantinides 2004, Lasisi et al. 2017). Davenport (2004, 2006) suggests that the analytics capabilities of the built-in business intelligence tools in Enterprise Systems can be used to make strategic decisions like identifying the most profitable customers and retaining them, determining the optimum price for maximum yield and selecting best employees at optimum compensation levels. This opens up several opportunities to consider, which were not available for analysis at the time of formulating the business strategy prior to having the system. Thus we see that informing using ES helps in both ‘organizational analysis’ (most cost-incurring departments) as well as environmental analysis (most profitable customers), as suggested by Harrison (1996).

Components like SAP’s Strategic Enterprise Management (SEM) suite assist in the actual strategic management process, including creation/recreation of the strategy. To examine and review new business opportunities, tools for executing the activities of strategic management are also built into most ERP systems, like SAP’s Business Planning and Simulation (BPS), Business Consolidation (BCS), and Corporate Performance Monitoring (CPM), which assist in both ‘informating’ to carry out the strategic management process. A study by Rom and Rohde (2006) suggested that a tight collaboration with ERP and Strategic Enterprise Management Systems (which is built-in to ERP Systems now) is very beneficial for a coordination of tactical and strategic decision making. Since it can be said that the availability of quality information in real-time, and the tools to analyze it support strategic decision making (Heidary et al. 2018; Holsapple, Sena and Wagner 2019), it is hypothesized that:

Hypothesis 3: The more the adopting organizations employ their Enterprise Systems to informate, the easier it is for them to make sound strategic decisions

It may be noted that the word ‘more’ in the hypotheses above refers to the extent to which

- (a) data and systems were integrated, as measured by the amount of data or the number of systems integrated (for Hypothesis H1)
- (b) processes were optimised, as measured by the number of processes optimized or the functional areas (for Hypothesis H2B)
- (c) informing was made possible, as measured by the amount of data made accessible and ready to be analysed (for Hypotheses H2A and H3)

Other Potential Relationships: Beyond Scope

There could be other relationships between the drivers and the business value created that can potentially be valid (eg: Integrate leads to Innovation). However, given that no evidence of other such relationships were found in the literature, and the constraints of time for finishing the study, these are not considered here. These relationships can be explored in the future.

TESTING THE VARIANCE MODEL WITH EMPIRICAL DATA

Methodology

Since this study involves the use of Enterprise Systems in organizations, the unit of analysis is organizations. However, a selection criterion was applied to choose the sites. This is as follows:

- Large firms with at least \$500 million plus USD yearly revenue
- Successfully ‘gone-live’ with ERP and/or CRM from any leading vendor
- Post-shakedown phase (i.e. 6-12 months after a major release)

A sample of 94 cases of large firms from across the world that have adopted an Enterprise System from the market leader vendor SAP was found online. Some of these cases were short (two pages or so) and some much longer and detailed (15-16 pages). These cases can be found at: www.sap.com/solutions/business-suite/erp/customers/index.epx and www.sap.com/solutions/businesssuite/crm/customers/index.epx. These cases were endorsed by the client firms and published as business transformation cases of customer organizations enabled by SAP ERP and/or CRM systems (including in-built business intelligence technologies). Analysis of the content of these user cases combines some of the strengths of a survey and a case study. Being reasonably content intensive, vendor-provided success cases provide some insight to each user organization, as is possible with case studies. In addition, the use of a large number of cases provides a means to obtain information across different industries in different parts of the world, as is done in a survey.

For this research, the cases thus obtained were subjected to content analysis. The success cases were downloaded and printed out in hard copies. Each success story was scanned and reviewed, one by one, to find evidence for the four propositions of the proposed framework. Wherever found, such evidence was marked and annotated using a coding scheme used for this purpose. Though not collected first hand by the researcher, these multiple stories provide verifiable data for review and analysis.

Since these user cases are provided by vendors, there can be two potential issues with such data:

- The data may not be considered to be credible
- The data may not truly reflect the opinions of the members of the client organizations
- However, these two issues are addressed in the following ways:
- These success cases are from the most reputed vendor of Enterprise Systems (SAP) and are publicly available; hence they bear little risk of being false
- These success cases contain the contact details of the organizations as well as their top management members with quotes from their interviews for verification

Moreover, use of vendor published success cases has been used widely in prior research on Enterprise Systems like the much cited work by Shang and Seddon (2002). This research methodology has been proved to be very useful in the area of Enterprise Systems research where the data is collected from publicly available documents that contain the insight and experience of the adoption of such systems from the client organizations' perspectives. These cases served as secondary data (Jarvenpaa 1991) for testing the proposed model.

Validity and Reliability

Validity can be defined as how precisely the account represents participants' realities of the social phenomena and is plausible to them. Validity is associated with honesty, authority and defensibility. In the current study, validity of the data is assessed by:

- Comparing the data with the available literature on benefits of Application Systems in general and Enterprise Systems in particular.
- Peer reviewing by involving other researchers to evaluate the data and ascertain whether the researcher has satisfactorily interpreted the data.

Reliability, is dependability or consistency and a living relationship between the researcher and the data. The concept of reliability deals with the issue of whether the process in which the research is conducted is trustworthy and consistent over a period of time. In the current study, reliability of the data is assessed by:

- Reviewing all empirical evidence iteratively
- Checking the transcribed data for accuracy
- Using data from organizations all across the world
- Reviewing all empirical evidence by peers and colleagues to assess the analysis and interpretation

Findings

Evidence to support the model is provided in two parts: Evidence of Causality and Evidence of Association.

Evidence of causality

The following section contains illustration of evidence found from the data from user cases to support the Variance Model and its hypotheses.

Hypothesis 1: The more the acquiring organizations employ their Enterprise Systems to integrate processes and data, the easier it is for them to undertake mergers and acquisitions

Canadian National Railway Company (CNRC) is one of the earliest freight railroads around the globe and a leader in the North American rail industry, based in Montreal, Canada. The company now spans across Canada, mid- America and Mexico. CNRC made a strategic decision to adopt ERP to address the following key themes: assist its growth strategy through mergers and acquisitions of 4 other railways, improve information levels and analytics capability for operational efficiency and assist in innovation and agility. The organization got SAP ERP and Product Lifecycle Management (PLM) suites implemented from 1999 to 2005. CNRC used the system for integrating systems and sharing information with its 22, 250 employees widely dispersed across North America.

“CN has integrated and consolidated the functionality and data from over 100 computer applications into one seamless SAP platform”. (F. Grisby, Senior Vice-President and CIO)

SAP ERP clearly assisted in consolidating the IT systems that resulted from the growth strategy of CNRC- Mergers and acquisitions. The CN Mergers with Illinois Central in 2001, Wisconsin Central in 2003, Great Lakes Transportation in 2005 and British Columbia Rail in 2005 were supported by the ES platform. CNRC's profits rose 34% to CAD 2 billion in 2006. Thus, integrating using Enterprise Systems was a causal enabler of mergers and acquisitions.

Hypothesis 2A: The more the adopting organizations employ their Enterprise Systems to informate, the easier it is for them to undertake innovation

Hypothesis 2B: The more the adopting organizations employ their Enterprise Systems to optimise processes, the easier it is for them to undertake innovation

Energen Corporation is a diversified energy holding company headquartered in Birmingham, Alabama with annual revenue of USD 1394 million. It has two lines of business: development of domestic, onshore natural gas, oil, and natural gas liquids reserves; and natural gas distribution in central and north Alabama. It implemented SAP ERP and Human Capital Management solution. The system was used to achieve streamlined payroll processing and achieve process innovation by completely automating W-2 processing. In addition, Energen can now run payroll simulations. Energen conducted a detailed engagement to map out all the organizational business processes to optimise them.

“With SAP software, we have been able to increase our payroll processing efficiency. Reconciliations are significantly smoother. Also, the system uptime has improved as access is available during payroll runs.” (Willie Shepherd, Manager of Payroll)

In addition, with enhanced reporting capabilities, Energen can now automate and integrate safety reporting (OSHA 300) and drug testing.

“Without it [SAP software], changing any business process would have been extremely difficult.” (Brunson White, Vice President and CIO)

Thus, optimising using Enterprise systems was a causal enabler of Innovation.

Hypothesis 3: The more the adopting organizations employ their Enterprise Systems to informate, the easier it is for them to make sound strategic decisions

Pick n Pay Group is a market-leading retailer in South Africa and operates hypermarkets, franchise stores, supermarkets, convenience stores, and clothing stores with annual revenue of 3.5 billion Euros. The firm adopted SAP for Retail, the SAP ERP and the SAP Net Weaver Business Warehouse. The SAP Business Suites enabled quicker access to a deeper level of detail in general ledger, simpler and real-time ledger analysis, and query resolution. Financial personnel can access in-depth general ledgers, drill down for better query resolution and analysis, and also analyze the regional ledgers online in real time. Simultaneously, stores can instantly view details of their actual expenditure. It also enabled the top level managers to react quickly to changes in the competitive markets. Finally, the retailer has the agility and flexibility to handle dynamic business needs and pursue strategic initiatives, like the opening of a chain of convenience stores.

“With SAP software as the foundation of our business system environment, we can pursue the business opportunities that distinguish us from the competition and allow us to be more responsive to customers.” (Bronwen Rohland, Director of Strategy, Information Systems, and Supply Chain & Sustainability)

Thus, informing using Enterprise systems was a causal enabler of making sound strategic decisions.

Evidence of association

A survey-like study using all the 94 cases in the aforementioned sample was done to assess the extent of statistical association between the dependent and independent variables of the hypotheses. A 4-point scale (0-3) was designed to measure the strength of evidence of the variables of the model in the sample where 0 meant no evidence of the constructs and 3 meant very strong evidence clearly mentioned as excerpts from interviews/text or clearly implied.

The cases were analyzed, one at a time, by the first author to assess the strength of evidence of each variable (e.g., Integrate and Mergers and Acquisition). Quotations from managers of the client firms as well as text and numbers in the body of the cases were searched for evidence and marked. For example, in the Canadian Railways case, as illustrated by the quotes provided in the previous section, and other such evidence, a score of 3 was given to the construct ‘Integrate’ for that case. Similarly, for each of the 94 cases, a score from 0 to 3 was assigned to each of the six variables in the model using the rules for scoring. This provided a dataset (as shown in Table 4) as the base for quantitative analysis to test the model.

Table 4: Sample Extract of the Dataset

Case	Integrate	Optimise	Informate	Innovation	Mergers & Acquisitions	Strategic Decision Making
Pick N Pay	3	3	3	3	0	2
Energen	0	3	3	2	0	2
Canadian Railways	3	2	3	0	3	0
Synopsis	3	3	3	0	3	0
Bentoel Group	3	2	3	0	0	0
Coca Cola Bottling	3	0	0	0	0	0
Digitel GSM	2	3	3	0	0	3
Lennox	3	3	0	2	0	2
Francotyp Postalia	2	2	3	3	0	0

Source: This Study

From the dataset obtained as shown by the extract in Table 4, Spearman's Correlation Coefficients (ρ) between the respective independent variables (Integrate, Optimise and Informate) and dependent variables (Alliance innovation, Process innovation, Reshaping Strategy) as per the hypotheses were calculated. As there is no dependent variable shown to be affected by multiple independent variables, there was no need to do a multi-variate analysis of the data. The results of these calculations are shown in Table 5:

Table 5: Evidence of Relationships of the Model

Hypothesis	Independent Variable	Dependent Variable	Spearman's Correlation Coefficient	Significance (p-values)
1	Integrate	Mergers and Acquisitions	0.26	0.01
2A	Informate	Innovation	0.37	0.00
2B	Optimise	Innovation	0.37	0.00
3	Informate	Strategic Decisions	0.29	0.00

Source: This Study

DISCUSSION

Overall, support for the causality for Variance model of the proposed framework was found. Again, for evidence of association, the significant ($p \leq 0.01$) positive correlation coefficients, as shown in Table 4 between the relevant variables of the model, supported the three hypotheses shown in Table 4. In particular, the results supported the following: the more the firms integrate using Enterprise Systems, the easier it is to undertake mergers and acquisitions (H1); the more the firms optimize and informate using Enterprise Systems, the easier it is to undertake innovation (H2); the more the firms informate using Enterprise Systems, the easier it is for them to make sound strategic decisions (H3). These correlation figures provided evidence of association between the constructs of the hypotheses, not of causality. However, the causality of the hypothesized relationships is supported by the extracts as shown in the prior section titled 'Evidence of Causality'.

CONCLUSION

This study, in an attempt to answer the research question, proposed a new model to establish relationships between the drivers of Enterprise Systems-enabled business value, (i.e., Integrate, Optimise, Informate) and the business value created (Mergers and Acquisitions, Innovation and Strategic Decision Making). The causal relationships proposed by the model were tested and reasonably strong evidence was found to support the propositions.

The contribution and novelty of this study is two- fold. Firstly, it proposed that Enterprise Systems can create business value beyond operational benefits, specifically through mergers and acquisitions, innovation and strategic decision making. Secondly, it identified the drivers of such ES-enabled business value, i.e., (a) integration using ES can drive mergers and acquisitions (b) optimization and informing using ES can drive Innovation and (c) Informing using ES can drive strategic decision making. All these hypotheses were tested and supported using empirical data.

This paper has implications for further research but identifying more relationships. For example, the 'integration' of data and processes with suppliers and retailers can lead to the innovation of a new supply chain process. So there is a potential link between 'integrate' and 'process innovation'. Specialized tools like SAP's Business Planning and Simulation (BPS) and Corporate Performance Monitoring (CPM) in ERP packages contain practices to help in 'optimising' the strategic management

process. So it could be possible that 'optimise' assists in 'strategic decisions'. More such relationships can be explored by future research. The limitation of this paper is that the empirical test conducted is limited to secondary user reports. However, this limitation also paves the way for further research. To improve the generalizability of the proposed model, it should be tested further with more empirical data using detailed case studies of a number of organizations.

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APPENDIX A: LIST OF CASES USED IN THE STUDY

Below is the list of the names of all the organizations used for this study.

Air France	Fulton County School	Powell
Air Products	Goldcorp	Powerwell
AMD	GPI	Prati
Aquarion	Grasim Industries	Propex
Arctoc Cat	Graybar	Prudential Asset
Asian Paints	Greenhech Fan	Rion
Aspen	Gruma	Ruchi
Bentoel Group	Htach Holland	San Louis Obispo
Bluewater Power Corporation	HP Latin America	Sentri
Brumbow Mills	Index Living Mall	Slade Gorton
Canadian Railways	Inelectra	Solae Company'
Check	Intelli	Spinmaster
Chep	Jab Josef	State Industrial
Cherry	JSL	Steelscape
Coca Cola Bottling	Lennox	Synopsis
Colgate Palmolive	Linfox	Takaoka
Computer Sciences Corporation	Mattson	Tallard
Conagra	Mediline	Tasty Baking
Coop	MEI	Tersano
Day and Zimmerman	Middle Tennessee Electric	Tessengerlo
Defence Logistics	MonierLifetilr	Thomas Steel
Digitel GSM	Monsanto	Thomasville Furniture
Directv	New York Power	Thrifty Foods
Eastman	Newport	Tomoegawa
Efi	Nippo	Trincherro Family Estates
Electra	Nova	United Illuminating
Embry Group	OKI Data	Universidad Techmilanio
Energen	Pacific Coast Supplies	US Dept of Defence
Fields	Paradeep Phosphates	Vertelus
Francotyp Postalia	PickN Pay	Wawa
Fujimoro Kogyo	Port of San Diego	

Source: This Study