



Optimising enterprise resource planning system to leverage a firm's absorptive and adaptive capabilities



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Background: Enterprise resource planning (ERP) systems of enormous amounts of data. In the case where uncertainties and volatilities exist in a firm's environment, this data can help a business to reconfigure and modify its capabilities to adapt to the emerging changes. However, as most studies have only focused on the evaluation of the methodologies and challenges of ERP implementation, only little seems to have been performed to evaluate how ERP systems can be scaled to leverage a firm's absorptive and adaptive capabilities.

Objective: This research explores how ERP systems can be optimised to leverage the acquisition and assimilation of new information to bolster a firm's absorptive and adaptive capabilities.

Method: Using a qualitative exploratory research approach, primary research was based on the manufacturing businesses in the Gauteng area. In this analysis, 23 operational managers who were purposively drawn from 23 manufacturing businesses were interviewed to discern how ERP optimisation leverages a firm's absorptive and adaptive capabilities.

Results: Enterprise resource planning was found to create a business system that leverages new information acquisition and assimilation. Although this spawns a firm's absorptive and adaptive capabilities, findings still revealed the adopted management philosophy and organisational culture to influence how ERP can be optimised to bolster the acquisition and assimilation of new information in product, operational and strategic changes and modifications.

Conclusion: The study concludes with a framework that offers new insights on how ERP can be optimised to bolster a firm's absorptive and adaptive capabilities.

Introduction

Enterprise resource planning (ERP) system's optimisation leverages a firm's absorptive and adaptive capabilities. Enterprise resource planning connotes the integrated business management software that facilitates the seamless configuration and integration of a firm's internal core activities with its external business networks. Such core internal functional activities often consist of sourcing, storage, manufacturing, distribution, administration and financial management activities. Enterprise resource planning systems enhance the synchronisation and linkage of such internal core activities with a firm's external networks of customers, suppliers, advertisers, competitors, financiers and government (Shaul & Tauber 2013:9; Shields 2001:19). As ERP creates an interactive interface between the business and its external business environment, it spawns the acquisition and assimilation of new information. This bolsters a firm's overall absorptive and adaptive capabilities. Absorptive capabilities refer to a firm's ability to recognise, acquire, assimilate and apply valuable, new, external knowledge to achieve the desired business outcomes (Volberda, Foss & Lyles 2010:931). Subsequently, this also spurs on a firm's overall adaptive capabilities. A firm's adaptive capabilities are its ability to undertake relevant analysis and sense the need to act by modifying its strategies, business models or products to respond to the unfolding industry and market trends (Hudakova & Misun 2014:3; Reeves, Love & Trillmanns 2015:19). By aiding the interactive interface of a firm with its external business environment, ERP generates enormous knowledge repositories on a firm's internal capabilities. It also offers detailed insights into the unfolding market and industry trends. This renders it possible for a firm to analyse and track the effects of the unfolding trends on its market performance. In case of turbulence, such new information aids capabilities' modifications to create new advantages that bolster a firm's capabilities to counter the emerging threats (Reeves & Deimler 2011:14). However, as studies on ERP have been focused more on ERP implementation than on its leveraging effects (Shaul & Tauber 2013:9; Shields 2001:19), discerning how ERP can be optimised to spawn a firm's absorptive and adaptive capabilities is still an important area that most of the contemporary studies have not explored. It is such a theoretical gap that this research seeks to fill by exploring how the ERP system can be optimised to leverage a firm's overall absorptive and adaptive capabilities.

Literature review

In most businesses, the motives for ERP implementation are often to bolster operational efficiency, as well as activities' integration and coordination. However, literature analysis implies, apart from bolstering operational efficiency, improved level of ERP optimisation also leverages a firm's overall absorptive and adaptive capabilities (Almajali 2016:549; Ghosh 2012:123; Shaul & Tauber 2013:9; Sheilds 2001:19; Verville, Bernadas & Halington 2005:665).

Enterprise resource planning system

Enterprise resource planning creates a configuration of critical internal activities that aids organisational diagnosis. It inspires the effectiveness of real-time monitoring and tracking of raw materials' sourcing. Enterprise resource planning also leverages real-time monitoring and evaluation of materials' storage, manufacturing, distribution, sales and cash flow management. Such organisational diagnosis enhances the acquisition of useful information that can be used for improving the efficiency of activities' flow along a firm's value chain (Boltena & Gomez 2012:40). Yet, besides facilitating organisational diagnosis, ERP also uses its external networks of customers, suppliers and competitors to gain insights into the unfolding industry and market trends (Boltena & Gomez 2012:40). This enables identification of new information that can be absorbed to enhance the implementation of different incremental improvement measures. Such new information may arise from new changes in the external business environment. It may also offer insights into the symptoms of the impending threats that may tend to be easily discernible from ERP data that indicate declining sales, financial performance and changes in customer orders. Even if new changes in customer tastes and preferences are not easily identifiable, ERP also enables the executives to acquire critical information on the changes in competitors' behaviours. It also aids the identification of the probable changes that may affect the sources of input, as well as the prices of supplies. All these enable the assessment of how a firm's capabilities can be reconfigured and modified to aid its ability to absorb and adapt to the emerging trends and changes (Govindaraju 2012:473).

However, the extent to which ERP is able to precipitate such business values depends on its overall effectiveness and functionality. To establish an effective ERP system, the process of ERP development and implementation often require the application of four main processes. These four processes consist of process analysis, configuration, customisation, extension and data migration to facilitate a business's adaptation to a new business approach (Hatamizadeh & Aliyev 2012:13). This process itself spurs analysis and generation of new information that can be assimilated to improve a firm's effective performance (Govindaraju 2012:473). It also enhances the establishment of an effective organisation's ERP system. However, some of the authors still view the process of ERP implementation according to three perspectives that encompass organisational,

business and technological perspectives (Teltumbde 2000:45; Verville & Halington 2003:58). In terms of the organisational perspective, the process of ERP implementation is often perceived as an organisational development process rather than a business or technological development process. It signifies that ERP implementation does not only entail the introduction of new processes and technology, but also a combination of organisational changes. Such organisational changes cause the need for holistic change and transformation of how different business activities are accomplished. The organisational perspective views ERP as an actor in the interaction of different organisational activities. As ERP is implemented, the organisational perspective reiterates that it not only changes the existing work methods, but also introduces new teams, departments, as well as work processes and practices. This implies to ensure the successful ERP implementation; the employees must learn to acquire new knowledge to adapt (Robertson & Sribar 2004). In contrast, the business perspective holds that ERP implementation is a process that changes the nature of doing business. It introduces new business practices and approaches that require business process re-engineering and change for a business and adapt to the new system. However, the technological perspective treats the process of ERP implementation as a technological process that elaborates on the system and its architecture, infrastructure, configuration and customisation before it can finally go into operation (Verville & Halington 2003:58). As the complete ERP system goes into operation, it creates an organisational system that enhances the acquisition and assimilation of enormous information. Such a system often also offers technologies and software that support different data analytics to acquire additional new information from the existing ERP data that can be used to improve a firm's performance.

Enterprise resource planning and data analytics

An effective ERP system facilitates the use of big data analytics' technologies and methodologies. Data analytics enhance thorough analysis and discerning of hidden critical new information that were previously not easily evident from the existing ERP data (Hanumanth & Prasada 2014:5). This edifies the eliciting of critical new information that can be used for improving a business's strategic and operational decisions. Enterprise resource planning systems, such as SAP, Oracle and MS Dynamics, offer algorithms that aid data association, classification, regression analysis and clustering (Hanumanth & Prasada 2014:5). Data association algorithms leverage the analysis of the relationship between two data sets. Through such analysis, businesses are able to discern the patterns in data occurrence. This enables businesses to use the existing ERP data to undertake predictive analytics to determine the kinds of outcomes that must be expected after the application of certain sets of strategies. From the existing ERP sales data, as well as data on customer behaviours from a firm's customer relationship management (CRM) system, sales managers are often able to undertake relevant predictive analysis. In situations of price changes that may arise from the modifications or elimination of certain aspects of a firm's

value offerings, predictive analytics enable management to discern the likely changes in customer behaviours and sales. This influences change and modifications of marketing strategies. The use of algorithms such as autoregressive integrated moving average (ARIMA) also leverages sales and marketing departments' forecasting capabilities (Gordon & Linoff 2010:19). While using mainly CRM data on customer behaviours, ARIMA algorithm aids the effectiveness of sales forecasting. The results of such analysis enable supply chain managers to review and adopt the appropriate sourcing and stocking strategies to align supply with demand. This improves inventory management. In the event that sales are predicted to decline, the results of such data analytics may also influence the conceptualisation and application of strategies that leverage customer attraction and retention (Better, Glover & Laguna 2007:477). Besides data association algorithms, ERP also offers critical data that render it easy for the use of data classification algorithms. Data classification algorithms aid the classification and comparing and contrasting of different groups (Gordon & Linoff 2010:19). This is important for benchmarking the performance of various internal departments, as well as benchmarking a firm's performance with those of its rivals. Such comparisons enhance the identification and remediation of the areas of shortfalls using the appropriate intervention strategies. Benchmarking also bolsters the acquisition of the best industry practices that must be assimilated.

However, the values of data classification algorithms are distinct from the ones induced by regression analysis algorithms. Using the existing ERP data, regression analysis algorithms enhance the prediction of certain unknown outcomes that may arise from the changes in customer behaviours or the reactions of the competitors. It enables marketing managers to spot new growth opportunities. In contrast, clustering algorithms often utilise the existing ERP customer data to make necessary clustering and segmentations. It enhances the understanding of the market dynamics, patterns of customer tastes and preferences, as well as the areas of customer concentration (Alnoukari, El Sheikh & Alzoabi 2010:359). Improved understanding of these factors is critical for determining the segments to target, as well as how the distribution and marketing strategies must be undertaken to reach the target market segment. Enterprise resource planning also enhances the acquisition of new information that can be used for improving a firm's existing production operations. Using data analytic techniques such as classification, clustering, association and sequential patterns, ERP aids simulation and optimisation of the existing production systems (Kibira et al. 2014:18). This enhances the identification of the areas where improvements can be undertaken to bolster a firm's overall operational efficiency. As these create cost and efficiency advantages, it also bolsters a firm's capabilities to counter the proliferation of cheaper disruptive quality innovations (Better et al. 2007:477). Yet, at the same time, using certain prebuilt Google analytics dashboards, as well as the integrated internal and external data feeds, ERP also enhances the acquisition and analysis of data from different partners and competitors'

websites. This aids surveillance on the competitors', actions as well as how their intended motives would affect a firm's market performance. It creates a unified organisational system that aids the acquisition of new information on the overall degree of industry hostilities and volatilities. The acquisition of this information enables businesses to gather and acquire new information. Such new information enhances the conceptualisation and application of new strategies, such as new product development or modifications of the existing business strategies or approaches (Volberda et al. 2010:931). Certainly, all these imply that it is through ERP-facilitated data analytics that businesses are able to acquire and assimilate additional new valuable information and knowledge from the existing data to leverage the overall level of a firm's absorptive and adaptive capabilities.

Enterprise resource planning and a firm's absorptive capabilities

Absorptive capabilities measure a business's capabilities to acquire and utilise new valuable information or knowledge from its external business environment. In the event of changes, this aids necessary capabilities' modifications to enable a firm's adaptation to such emerging trends (Volberda et al. 2010:931). Cohen and Levinthal's (1990) model for absorptive capabilities reiterates an enterprise's absorptive capabilities to consist of three main dimensions: recognition, assimilation and the application of valuable new knowledge to achieve the desired commercial ends. A business's capabilities to acquire and integrate new knowledge in its products and operational processes influence increment of the stock of its knowledge repositories. These knowledge repositories are acquired from the knowledge and information which are accumulated through research and development (R&D), technical expertise and production experience (Girneata 2014:5). As the business interacts with its internal and external business networks, this knowledge influences the recognition of new information that may be of value for leveraging an enterprise's effective performance (Reeves et al. 2015:19). Such new information may encompass new data on better industry practices that are being widely adopted by different industry operators. It may also encompass information on the changes in competitors' behaviour which, if a firm is not able to review and change its business approach, would significantly affect its performance (Girneata 2014:5).

Other valuable information may arise from the emerging changes in customer tastes and preferences. Such changes may either support the existing product features or disfavour such products to instead favour the competitors' products. The acquisition and assimilation of such information depend on the skills and competencies of the personnel in the R&D department. It also depends on the information systems such as ERP systems that a firm has invested in. Besides the resources available at a firm's disposal, a flexible organisational culture that supports the frequent discerning of the prevailing trends to identify and utilise new information may also tend to enhance recognition, acquisition and utilisation of new

external knowledge (Reeves et al. 2015:19). New knowledge acquisition and utilisation are also determined by the level of social interaction between different cross-functional teams. It is influenced by the interface between the personnel in key functional departments and those in the external business networks. As businesses acquire this new knowledge to make necessary modifications of their capabilities, it tends to leverage not only their absorptive capabilities, but also their overall capabilities to adapt to the emerging trends.

Enterprise resource planning and a firm's adaptive capabilities

Adaptive capabilities connote a firm's capacity and ability to modify and adjust its enterprise architecture to cope with the emerging industry and market turbulence (Stefano, Peteraf & Verona 2010:118). Enterprise architecture is a configuration of critical interwoven operational methods and systems that consist of structural, behavioural, social, technological and critical operational facilities. To adapt to the emerging changes, businesses need to reconfigure, modify and change their enterprise architectures. The development of an adaptive capability architecture facilitates change and the shifting of an enterprise's operation from one industry and market conditions to another. The overall flexibility and agility of adaptive capability architecture is often also aided by certain coherently interwoven inner and outer layers. The inner layer of an enterprise's adaptive capability architecture consists of largely flexible management systems, leadership styles, behaviours and practices that support a firm's adaptability (Augier & Teece 2009:410), and the outer layer of an adaptive capability architecture influences the linkage of an enterprise's inner layers with its external environment. This linkage that is also in most of the cases facilitated by ERP, aids frequent analysis and intelligence gathering to improve the executives' awareness and realisation of the devastating magnitudes of the unfolding changes. This enhances the identification of relevant modifications that can be undertaken to leverage a firm's overall adaptability. It spurs improvement of a firm's capabilities to read, sense and act on signals. It also improves a firm's ability to experiment and try different alternatives that would enable the modifications of its capabilities to match the unfolding volatilities in the external business environment (Ambrosini, Bowman & Collier 2009:8).

With more flexible management systems, business philosophies and resources, it often turns easier for firms to commit the requisite resources even if it would seem risky to do so. The improved ability of an enterprise to experiment and try different versions of business approaches improves a firm's innovative capabilities. Subsequently, this leverages the utilisation and assimilation of the unfolding new information or knowledge to create new products or improve the quality and features of the existing products to respond to the unfolding changes (Argote & Ren 2012:137). It is such initiatives that spawn a firm's absorptive and adaptive capabilities. However, as studies on ERP have been focused more on ERP implementation than on its leveraging effects (Shaul & Tauber 2013:9; Shields 2001:19), discerning how ERP can be optimised to spawn a firm's absorptive and adaptive capabilities is still

an important area that most of the contemporary studies have not explored. It is such a gap that this research seeks to fill.

Research statement

A limited number of studies on the edifying effects of an ERP system have restricted the evaluation of how ERP systems can be scaled to leverage a firm's absorptive and adaptive capabilities.

Research purpose

The purpose of this research is to explore how an ERP system can be scaled to leverage acquisition and assimilation of new information that, in turn, bolsters a firm's overall absorptive and adaptive capabilities.

Methodology

To discern how ERP can be optimised to leverage a firm's absorptive and adaptive capabilities, the study used a qualitative exploratory research approach (Clark 2010:428; Morse 2010:483).

Research design

With most of the studies concentrating on examining the methodologies and challenges of ERP implementation, the use of a qualitative exploratory research approach was critical for eliciting enormous critical in-depth information on ERP optimisation. The eliciting of such in-depth information was considered critical for discerning how ERP can be scaled to leverage a firm's absorptive and adaptive capabilities. The qualitative exploratory research design connotes an ontological approach that focuses on eliciting in-depth information that offers detailed descriptions of the organisational phenomenon being researched (Bluhm et al. 2011:1866). As contrasted to the quantitative research approach that only offers summarised numerical responses, a qualitative research approach aids ease of information interpretation and the extraction of the underlying rich facets of facts that explain the phenomenon being investigated (Clark 2010:428). In effect, the application of a qualitative exploratory research approach was considered critical for aiding thorough analysis and evaluation of the two fundamental research questions that were to assess how ERP's optimisation bolsters a firm's absorptive and adaptive capabilities, as well as the constraints that mar the realisation of ERP's leveraging effects on a firm's absorptive and adaptive capabilities. Such an analysis was considered to be critical for discerning a framework that could be extracted to explain how businesses can optimise their ERP systems to leverage their absorptive and adaptive capabilities. To accomplish this, the primary research was based on 23 businesses in the manufacturing sector that are based in the Gauteng region.

Sampling

To enhance the eliciting of information relevant to the study, purposive sampling was used to draw only the manufacturing businesses that have used some form of ERP systems, such as

SAP, Oracle and MS Dynamics (Morse 2010:483). Some period of about 10 years of using ERP after its implementation was also required. This is attributable to the fact that businesses that have used ERP for a longer period were construed to possess a holistic understanding of ERP values, as well as how it can be scaled to perform other functions. The manufacturing businesses to be selected were also required to have some relatively larger scale of operation that spans across three regions or more with about 500 personnel and a net turnover of over ZAR 8 million. The size of the manufacturing business was considered critical for analysing how ERP integrates a firm's complex networks of its internal structures with the external networks of suppliers, customers, business partners, competitors and government to acquire critical new information and adapt in the midst of more complex industry dynamics. Brief interviews were conducted with personal contacts and references, as well as certain selected employees in 30 target manufacturing enterprises to ensure compliance with these criteria. These initiatives were undertaken in conjunction with the analysis of the websites, company archives, media reports, financial statements and annual reports of these 30 selected manufacturing businesses. Using personal contacts and references in some of these manufacturing businesses, purposive sampling was accompanied with snowballing to engage the relevant managers to have their businesses participate in the study. As each business consented to participate in the study, this influenced the sampling of one manufacturing enterprise after the other until a sample of 23 manufacturing enterprises was obtained. However, to enhance the eliciting of relevant information, the study only focused on the operational managers with the effect that 23 operational managers were drawn from these 23 sample manufacturing businesses. This is attributed to the fact that by the nature of their work, operational managers were better placed to understand and describe how ERP leverages the acquisition of new critical information to bolster the manufacturing enterprise's absorptive and adaptive capabilities.

Data collection

While some of the operational managers opted for telephonic interviews in the period between March and November 2017, others elected to use the weekends to relax and do face-to-face interviews. Each of the interview participants was asked to respond to the following questions:

- Briefly describe how the manufacturing ERP in your organisation works as well as its benefits for your organisation.
- How do you utilise your ERP system to read and track changes that are unfolding in the external business environment?
- How are the results of such analysis utilised for modifying your manufacturing capabilities and strategies to respond to the unfolding market and industry changes?
- How do you use your ERP data to track your sales, customer orders, revenues and profitability as well as the market performance of your products?
- How do the results of such analysis influence the change of your internal operational strategies as well as the market strategies?
- How do you utilise your manufacturing ERP system to understand and gain information on your customers, suppliers, business partners and competitors?
- How do the results of such analysis influence the change of your market strategies?
- How is your manufacturing ERP utilised to evaluate and track the effectiveness of your manufacturing processes as well as the identification of the new improvement strategies that must be adopted?
- How is your manufacturing ERP utilised to evaluate and track the market performance of your products as well as the identification of the new improvement strategies that must be adopted?
- Do you quite frequently utilise your ERP to undertake relevant data analysis and interpretation as part of the organisational culture? If not, why?
- What are the challenges that you face when seeking to utilise new information from your internal and external ERP networks to improve the performance of your business?

Even though interviews were based on these open-ended questions, further probing and re-probing were still undertaken to gain detailed insights into new information that were emerging from the participants' responses. This enhanced data enrichment. Interview responses from both telephonic and face-to-face interviews were transcribed as the interviews were undertaken. The obtained interview data were thematically analysed to discern and identify themes that explain ERP's leveraging effects on a firm's absorptive and adaptive capabilities as well as its associated paradoxes.

Data analysis

For data analysis, the study used Fetterman's (2009) four-stage framework of thematic analysis to read and re-read the interview data, identify, define and interpret the emerging relevant key concepts. While using this framework to inductively allow key concepts and sub-concepts to naturally emerge as the findings were analysed and interpreted, thematic analysis and extraction of the relevant key concepts were accomplished in two phases. The first phase analysed ERP's leveraging effects on a firm's absorptive and adaptive capabilities. The second phase of thematic analysis examined the paradoxes of ERP's leveraging effects on a firm's absorptive and adaptive capabilities. In terms of the first phase, thorough analysis and interpretation of the interview data from each operational manager was undertaken to discern and extract in literal terms the activities that ERP accomplishes for each manufacturing enterprise. These results from each interview participant were compared and contrasted with each other to identify and extract the common themes in and meaning on what ERP does for manufacturing enterprises. Common themes in literal terms

were getting, analysing and utilisation of information. The suitable term for describing the process of getting information from a particular source was codified as acquisition. While data analysis was left as data analysis, the process of utilising information was codified as assimilation. The identification of these three main themes (acquisition, analysis and assimilation of information) was followed by the identification of how the sub-concepts that were emerging from each set of interview responses offered coherent explanations of how ERP leverages a manufacturing firm's absorptive and adaptive capabilities. Sub-concepts that describe how a manufacturing firm gets structured and unstructured data from different sources were construed to explain the process of a manufacturing ERP's information acquisition. However, the acquisition of different data was found not to imply that manufacturing enterprises utilise all such information. To utilise the array of different pieces of information, data analysis is critical for enhancing the extraction, acquisition and assimilation of additional new information from the existing structured and unstructured data. In effect, sub-concepts that describe data analysis were extracted in conjunction with their accompanying explanations from the interview responses to explain how data analysis mediates both the acquisition and assimilation of new valuable knowledge. In contrast, only sub-concepts and their accompanying explanations from the interview responses that describe how manufacturing enterprises utilise different information were extracted and used to explain the concept of assimilation. Similar processes and approaches were also used in the second phase of thematic analysis to identify key concepts that explain the constraints that mar the realisation of the desired ERP's leveraging effects on a firm's absorptive and adaptive capabilities. This process influenced the extraction of two concepts that included poor ERP optimisation and costs of ERP implementation. Thereafter, further analysis was undertaken to extract sub-concepts and their accompanying explanations from the interview findings to describe how poor ERP optimisation and costs of ERP implementation mar the realisation of the desired ERP's leveraging effects on a firm's absorptive and adaptive capabilities. As the entire study was being undertaken, measures were also undertaken to enhance the validity and reliability of the study.

Validity and reliability

Validity and reliability of the study were enhanced by improving its credibility, dependability and transferability (Gioia, Corley & Hamilton 2013:15). To improve the credibility, dependability and transferability of the findings, purposive sampling was used to ensure that only businesses that have used ERP for a period of 10 years were selected. This improved the validity and reliability of the findings on the basis that businesses that have used ERP systems for longer periods were better placed to offer holistic insights into how ERP can be scaled to offer an array of different advantages. Because of the fact that by the very nature of their work, operational managers are better placed

to understand how ERP systems work, the study was also only based on the opinions of the operational managers. Triangulations were undertaken during the discussions of the findings to discern the extent to which the findings were supported or disputed by the existing theories on ERP, as well as theories on a firm's absorptive and adaptive capabilities. This improved the overall credibility, dependability and transferability of the findings on the basis that if a similar study is to be undertaken again, it is most likely that it is still such similar findings that would be obtained. As this also enhanced fact-checking, other measures for enhancing credibility, dependability and transferability also entailed comparing and contrasting interview responses on the emerging similar concepts to test the veracity of the findings. During the presentation of the findings, direct verbatim quotes from the participants were also inserted to ensure that the messages that the participants aimed to convey were not distorted. Against this analysis, a framework was extracted to explain how businesses can optimise their ERP systems to leverage their absorptive and adaptive capabilities. The details of the findings are as follows.

Results

Results of the thematic analysis of the findings are presented in two sections that encompass:

- enterprise resource planning's leveraging effects on a firm's absorptive and adaptive capabilities
- constraints of realising ERP's leveraging effects on a firm's absorptive and adaptive capabilities.

Enterprise resource planning's leveraging effects on a firm's absorptive and adaptive capabilities

It emerged from the findings that depending on the management philosophy and organisational culture, ERP optimisation leverages the acquisition and assimilation of new knowledge to bolster a firm's overall absorptive and adaptive capabilities.

Acquisition of new information

Depending on the management philosophy and organisational culture on how ERP can be utilised, findings imply that ERP offers detailed insights on the unfolding trends to enable key sales personnel gain insight into the changes in market trends. Such changes in market trends may highlight either probability for increased demand or low demand. It was reiterated in the findings that it is from such information that the manufacturing businesses often determine the overall sourcing strategies, as well as the production scheduling strategies that must be adopted to balance supply with demand. This lowers the overall costs of inventory management. Such views were mainly common in most of the responses to the interview question that explored how the manufacturing businesses utilise their ERP systems to read and track changes in sales, customer orders, revenues and profitability, as well as the market performance of their products. However, in some of

the responses to the interview question that required the participants to briefly describe how the manufacturing ERP works, as well as its benefits, some of the businesses were found to adopt management approach that deliberately limits ERP use to the accomplishment of basic fundamental functions of information storage, communication and activities' coordination. In such an approach, some of the businesses also indicated to limiting ERP utilisation to simple analysis of sales and profitability and not for undertaking environmental mega-analysis to discern the unfolding trends. However, where threats are identified, such businesses were found to resort to ERP to track and acquire new information on new solutions that can be adopted. Such an approach limits the utilisation of ERP to acquire critical information on how a business's performance can be improved. Such a view was derived from the opinions of one of the operational managers from the tyres manufacturing plant in Woodmead, who stated that:

'Our ERP is mainly aimed at accomplishing basic functions such as facilitating communication, storing records and information and coordination of activities across different platforms. Although in the accomplishment of such processes, it acquires and stores enormous information which is not of much value to us in some of the cases, information acquisition is not what we regard as one of its fundamental functions. We mainly focus on the fact that it lowers the costs of communication and improves the coordination of activities. Even if there is a threat to our performance, we do simple analysis of sales and profitability, and not more complex analysis of the market and industry. Although we do periodic analysis to understand the state of our performance, we do not focus much on unnecessary data accumulation from different sources.' (Participant 18, 33 years, male, IT operational manager)

Even if some of the managers often aim to scale their ERP to perform more complex functions of information acquisition and analysis, further probing and reprobing of the responses of one of the operational managers still indicated that the ERP technology in which the business has invested may tend to be a major challenge. She argued that some ERP technologies do not support more complex big data gathering and analysis. In contrast to such findings, some of the operational managers reiterated that their manufacturing ERP is mainly used for acquiring and interpreting critical data that enable the reading and tracking of the changes in the organisational performance, as well as the changes in sales, customer orders, revenues and profitability. In such an analysis, the findings revealed that the major symptoms of demand increases or slowdowns are often easily discernible from the data and information generated through frequent real-time interactions across different functional departments. While declines in customer orders are often interpreted to suggest an impending decline in the demand for identified products, it was also reiterated in the findings that the other information that also suggests likely future decline or increase in demand is often reflected in ERP financial data. In such ERP financial data, risks of decline in sales, revenues and profitability were noted to imply risk of likely impending product declines. In effect, a consistent decline in

the performance of the products that have been performing relatively well was emphasised to signify that a business must review its sourcing strategies, as well as production scheduling, to source and produce only units that would match the existing demand. This process leverages the overall effectiveness of forecasting and the undertaking of relevant proactive initiatives to respond to industry changes before the impact of the unfolding changes turns out to be quite devastating. Such a view is corroborated in the opinion of one of the production managers from the plastic containers manufacturing plant in Centurion, who stated that:

'Our ERP enhances consistent analysis of the emerging data. It enables one to figure out what is happening in the industry. If you already have sufficient information on customer order trends as well as sales and revenue generation across different periods over the years, it becomes easier for one to easily detect that significant declines in customer orders, sales and the generated revenues are generally symptoms of the changes that are most likely to emerge. In effect, to circumvent such situations, one has to intervene and review the sourcing plan as well as production scheduling before it is too late. This is because, persistent declines in customer orders and sales generally suggest that there is something wrong. It could be a new competitor entering the market or just that the customer businesses are not performing well due to the reasons that have to be explored by analysing the accumulated ERP data and information.' (Participant 6, 44 years, female, operational manager)

Such a finding suggests that ERP aids the analysis of the explaining trends behind the changes in market trends. Such a view is accentuated in the opinions of one of the operational managers who argued that: 'ERP only reveals declining performance and leaves the rest to the organisation to explore and find out the causes of such poor performance'. However, she explained that it is not in all the instances that a decline is detected that immediate interventions are undertaken. In most of the cases, some of the businesses tend to take risks and wait for such threats to become serious before undertaking any interventions. She attributed this to the fact that in some of the cases, the causes of failure may be arising from temporary factors such as seasonal variations or temporary economic turbulence that temporarily affects consumers' purchasing power and sales. However, for manufacturing firms that sell to the other businesses for resell, views from some of the operational managers revealed that if the challenge is not arising from the fact that most business customers are not performing well, in certain cases, it could be the emergence of new competitors. Some of the operational managers attributed this to the fact that when new competitors are entering the market, they tend to use market penetration strategies to attract and capture new customers. In effect, some of the customers tend to shift to buy from such new manufacturers. This causes a decline in customer orders, sales and revenues in the original manufacturing business. Even if that is not the reasons, explaining the decline in the demand for certain products, some of the managers still noted that in certain cases, customer tastes and preferences just change all of a sudden to favour alternative brands. These behaviours often cause

sudden changes in demand to affect the levels of customer orders, sales and revenues. Such a finding is echoed in the opinions of one of the operational managers from the meat processing and packaging plant in Germiston, who argued that:

'If the business has several customers, it is difficult to tell whether customers are defecting or not. But the ERP data can easily indicate that by comparing the current sales, orders, revenues and profitability with the previous seasons where the business was performing well. If the previous good performance was due to seasonal factors such as festive season, it can also be easy to tell. If it is due to the changes in the economy which is affecting consumer purchasing power, ERP data will also easily reveal just like when the cause of poor performance is maybe arising from the sudden change in customer tastes and preferences. This is because information from ERP data motivates the need for further research to identify the actual causes of failure.' (Participant 20, 28 years, female, operational manager)

Such a view corroborates the responses of most of the interview participants to the question that explored how the manufacturing enterprises use their ERP systems to understand and gain information about their customers, suppliers, business partners and competitors. In such responses, most of the operational managers said that even if ERP does not reveal declining customer orders, sales and revenues, intense interactions between the business and its customers, suppliers and other business partners were reflected in the findings, enabling executives to determine whether the unfolding changes in market trends are arising from the introduction of new government legislations or not. Such an analysis was also noted in the findings to determine whether such changes arise from the emergence of new market dynamics that could affect the performance of the businesses in the identified industries. However, in the descriptions of how the manufacturing ERP system works, as well as how ERP can be optimised, some of the participants reiterated that ERP not only aids the direct acquisition of structured and unstructured data, but also data analysis to enhance the extraction and acquisition and assimilation of additional new information or knowledge from the accumulated ERP data.

Enterprise resource planning data analysis: As ERP gathers data from different internal and external transactions and activities, findings imply that most of the information is often unstructured. Often it is not easy to make sense of an enormous amount of unstructured data like this. This affects the level of operational performance, as well as the areas of constraint that must be addressed. Such themes were common mainly in the responses to the interview question that examined how the manufacturing enterprises utilise their ERP data to evaluate and track the effectiveness of their manufacturing processes, as well as the identification of new improvement strategies that must be adopted. In most of such themes, most of the operational managers explained that, as ERP only acquires unstructured data, without analysis, most businesses are often unable to draw new

insights from them. It suggests that without data analysis, the level of new information acquisition and assimilation is also reduced. Data analysis was reiterated to aid the processing of ERP data in order to extract valuable new information that can be easily used. This view resonates in the opinions of one of the operational managers from the beverage processing plant in Ekurhuleni, who stated that:

'Some of the new information and knowledge are often easily evident from the emerging ERP data. However, in most of the cases, it is only through intense data analysis that we have been able to gain new insights on how to improve our performance.' (Participant 14, 39 years, female, operational manager)

In the accomplishment of such analysis, concept analysis of the interview findings indicated that there are two approaches that are used for extracting critical information from the existing ERP data. These approaches consist of the guided approach and the blind approach to ERP data analysis. In the guided approach, one of the operational managers noted that the process of analysis is initiated and subsequently guided by the challenge that the business is facing. In case of the declining sales or rising operational costs, the process of data analysis is guided by the quests to explore and identify the causes of such challenges. Such a finding is substantiated in the views of one of the information technology (IT) operational managers from the electronics assembling and manufacturing plant in Centurion, who noted that:

'Of course one of the benefits of ERP is that it enhances several analyses. However, we do not undertake data analysis just because enormous data is availed from the ERP systems. It is costly to do so as the business may require several permanent staffs to do that. Instead, we tend to maintain a lean data analysis staffs that highlight areas of common challenges such as sales, revenues, profitability, quality, costs and process efficiency that can be tracked almost on a daily basis. A part from that, we tend to wait for problems to arise and guide us on the areas to focus on. Such approach is more cost-effective as it mitigates unnecessary interference with the ongoing processes for the accomplishment of different activities.' (Participant 9, 38 years, male, operational manager)

This view implies that relevant data analysis is only undertaken if the overview of the unfolding structured and unstructured ERP data indicates a problem. In contrast, some of the operational managers emphasised that as much as they also tend to use such an approach, in certain cases, a blind approach to ERP data analysis is also undertaken. Quite often, they explained that the motives of such analysis are not only to identify the actual unfolding problems, but also to spot the areas where problems are most likely to arise. In the application of this approach, findings imply that some of the manufacturing businesses tend to engage in data analysis and sales forecasting even if it is not evident from the existing ERP data that there is a threat. Such a view was common in most of the responses to the interview question that examined how the manufacturing firms use different results of ERP data analysis to modify their manufacturing capabilities and strategies to respond to the unfolding

changes in the and industry changes. In such responses, some of the operational managers noted that ERP data analysis is undertaken to enhance the proactive analysis and identification of threats that must be mitigated or prevented by developing and preparing a contingent plan or remedy that will be utilised if such threats occur. Even if there are no operational challenges that are easily identifiable from the unfolding ERP data, some of the operational managers also revealed that they tend to utilise the emerging ERP data to engage in a different process of simulations and optimisation. This enables the proactive analysis and testing of the effectiveness of the existing processes, machinery, quality management systems and operational approaches to continue delivering the desired outcome. Such a finding is accentuated by the opinion of one of the operational managers from the beverage manufacturing plant in Woodmead, who stated that:

‘Even if there are no challenges, ERP data analysis still enhances the proactive understanding of the competition dynamics in terms of the pricing, marketing and promotional strategies and the emergence of new products. If the result is that the business is not having a price advantage that means you must review all your cost drivers to develop cost benefits that would offer you price advantages in the market. If your marketing and promotional strategies are not competitive, that means you must conduct analysis of your existing ERP data to assess how most of your target markets can be best reached by changing and modifying your existing marketing and promotional strategies. In case of the emergence of new products, that, means you can use your ERP data on product ingredients to determine how the existing product features and attributes can be modified to counter the values that such new products are offering.’ (Participant 11, 33 years, male, operational manager)

In other words, these findings suggest that businesses tend to use a combination of reactionary and proactive approaches to analyse and extract relevant new information from the existing ERP data. It also implies that ERP aids not only the acquisition of new structured and unstructured data, but also the analysis of the existing ERP data to extract new information that can be acquired and assimilated in management decisions on how a business’s performance can be improved. The identification and acquisition of such new information enable the assimilation of new information on the modification and improvement of a firm’s capabilities to absorb and adapt to the emerging new industry and market changes.

Assimilation of new information

The view that ERP leverages the assimilation of new information was largely evident in most of the responses to the interview question on how the manufacturing businesses utilise the results of relevant ERP data analysis to modify their capabilities and strategies to respond to the unfolding market and industry changes. In most of such responses, ERP was acknowledged to aid the acquisition and assimilation of new information that leverage the improvement of process efficiency, product modifications and strategy modifications. In terms of the improvement of process efficiency, some of

the operational managers noted that ERP enhances analysis and identification of process deviations that not only cause the escalation of operational costs, but also deviations from the prescribed quality specifications. This motivates the need for exploring the causes of such deviations using process control and improvement methodologies such as sigma analysis, control charts and Pareto charts. As such a process diagnosis is being undertaken, descriptions in the interview responses indicated that it also enhances the identification of new improvement measures that must be adopted and assimilated as part of the operational improvement processes and methodologies. However, some of the operational managers argued that the extent to which such initiatives are undertaken to influence the improvement of a firm’s performance depends on how the management utilises the accumulated ERP. In some cases, some of the operational managers noted that most of the accumulated ERP data are often discarded without any analysis in order to extract and assimilate new information which may improve the firm’s performance. Such a finding is corroborated in the opinions of one of the operational managers from the building material manufacturing plant in Woodmead, who stated that:

‘Of course ERP facilitates the acquisition and storage of enormous data from activities such as customer payments, enquiries, payrolls, employee performance data, customer orders, orders for supplies from suppliers and different financial and accounts transactions. However, apart from strategic planning, in most of the cases, such ERP data are stored and later discarded without undertaking any analysis to extract any new knowledge. This is because in most of the cases, ERP is widely preferred because it lowers the cost of communication as well as the ease and costs of managing different scattered departments and units and not necessarily for acquiring new information about competitors or product performance. We operate in a relatively stable industry that does not require frequent new information for frequent changes of strategies and products.’ (Participant 7, 47 years, female, operational manager)

In other words, in addition to the management philosophies on how the accumulated ERP data must be utilised, findings also imply that the overall degree of industry volatilities and uncertainties may also influence the engagement of businesses in the analysis of the existing ERP data to acquire and assimilate new information on how to counter the emerging industry threats. However, in the responses to the interview question that required the participants to briefly describe how the manufacturing ERP works, as well as its benefits, some of the operational managers revealed that they tend to use their ERP to only acquire and store simple sales and revenue data. In such an approach, the analysis and acquisition of the megachanges in the external business environment are often not perceived as part of what ERP can accomplish. Such a finding is corroborated in the opinions of one of the operational managers from the vehicle tyres manufacturing plant in Woodmead, who stated that:

‘We don’t really rely on ERP for external information to change or modify our products. Our products are standardised and we conduct scientific tests and analysis to assess how to improve using our own professional judgment. We don’t rely on any

customer views or any ERP data. A business is only concerned about the views of its customers and competitors as well as what is happening in the market if it does not trust its products. In our case, we trust our products. Our products rely on scientifically tested process of development and therefore no customer or competitor can tell us how it should be done. No ERP data is required for such a process.' (Participant 18, 33 years, male, IT operational manager)

Such a managerial approach often affects the utilisation of new information that is emerging from the external business environment to make relevant operational and product modifications. Such a view is accentuated in the fact that in the event of industry instabilities that are arising from the introduction of rival products that affect the performance of the existing products, the findings revealed that if ERP data indicate a persistent decline in customer orders, sales and revenues, product modifications are often undertaken to enrich the features, attributes, design and quality of the existing products. These initiatives are often undertaken to bolster the overall attractiveness of the existing products. Such themes were mainly common in the interview responses that explored how manufacturing businesses utilise their ERPs to evaluate and track the market performance of their products, as well as the identification of new improvement strategies that must be adopted. In such responses, one of the operational managers argued that if from ERP analysis, it emerges that poor performance of the product is arising from its maturity or the looming decline of the product, information on customer needs and preference which is gained through ERP data analysis, often reveals the type of new products that must be developed. Quite often, the application of such strategies aids the repositioning of the enterprise to counter the emerging competition threats. This certainly implies that ERP aids the acquisition and assimilation of new information in product modifications or the development of a new product to leverage its overall absorptive and adaptive capabilities. Such findings are also accentuated in the views of one of the operational managers from a firm that manufactures different items such as tinned fish, salt and sanitary materials who stated that:

'Information gained through ERP data analysis is important for understanding what customers want. Even if the existing products are performing well, such information still helps when developing a new product. When developing new products, the existing ERP system helps make customer data readily available for relevant analysis. This helps to the extent that even if we are sending out research agents and marketers to do further analysis, from ERP information repositories, they often have some glue on where to begin from.' (Participant 16, 41 years, male, operational manager)

Besides the assimilation of new information that aids process and product modifications, views from the other operational managers indicated that the information gained from ERP analysis and liaison with different external business partners often aid the acquisition of new information that can be integrated in strategy modifications. Such a theme was mainly common in the responses to the interview question that examined how the manufacturing

enterprises use the ERP data on their customers, suppliers, business partners and competitors to undertake the necessary changes in their market strategies. However, even if strategy modifications are critical for leveraging a business's sustainability, some of the views in such responses still indicated that many businesses only reservedly use their ERP data to modify their strategies. Such businesses revealed that unless the threat becomes unbearable, they usually tend not to utilise their ERP data to make the relevant strategic changes and modifications. Cases where a business's performance was found to be threatened were noted to arise from declining quality, escalating operational costs and the emergence of several low-cost competitors. This view is corroborated by the opinion of one of the operational managers from the plastic containers manufacturing plant in Centurion, who argued that:

'Of course ERP data enables to track trends as they unfold, but we rarely use it for modifying our strategies. We use it once in a while, where the threat is identified as real like in the case where we had to acquire a smaller plastic containers' manufacturing entity that had the ability to produce plastic containers at the cost cheaper than what we were able to do. This enabled us to counter the threats where almost everyone was producing plastic containers at the cost which were lower than us. Apart from such situations, our ERP data has not been that very valuable to us. In fact in most of the cases, we delete the old information to create space for the new ones.' (Participant 12, 37 years, female, operational manager)

Besides threats of cheaper products, subthemes from the other operational managers also revealed that ERP data may offer detailed insights into new information that may reflect emerging common industry practices, such as internationalisation, to avoid risks of competition and saturation of the existing markets. The identification of such information instigates the need to weigh the overall level of attractiveness of the existing industries in future. In such an analysis, a higher rate of internationalisation of the businesses in the industry in which a firm operates was noted to imply likely future risks of industry decline or high rates of industry volatilities. This influences the need for strategic modifications to diversify and remain in the local domestic market or to internalise and approach new markets with the existing products. Such a finding resonates in the responses to the interview question that explored how the manufacturing businesses utilise the results of ERP analysis of different industry dynamics to modify or change their strategies. In such a response, one of the operational managers from the steel manufacturing plant in Midrand argued that:

'ERP data analysis enabled us to spot risks of the emergence of the declining attractiveness of the steel industry 10 years ago. When some of our customers started not to renew their contracts one after the other, we wondered where they were going to change to and buy steel. We thought they were defecting to our competitors. But when, we used our ERP system to gather import data and conduct relevant analysis, we discovered that most of the customers in the local steel industry were increasingly changing to import steel. We noticed that steel products from China were quite cheaper than ours, and most of the customers were becoming aware about that. Using

our ERP data, we did a “what if? analysis” to undertake further analysis on whether if such a trend was to continue, what would be the future implications on our performance? We predicted that our steel industry would be threatened in future, and we diversified into real estates’ development. Such approach enabled us to insulate ourselves from the current risks of the increasingly declining attractiveness of the steel industry on the basis that even though the market is performing poorly, we are still able to utilise our own steel in real estate development that we resell.’ (Participant 17, 52 years, male, operational manager)

Certainly, all these demonstrate the extent to which ERP aids the acquisition and assimilation of new information to leverage a firm’s overall absorptive and adaptive capabilities. However, despite such leveraging effects of ERP, it still emerged from the findings that in certain cases, ERP’s leveraging effects on a firm’s absorptive and adaptive capabilities have often been constrained by certain inherent weaknesses of different businesses.

Constraints of realising enterprise resource planning’s leveraging effects on a firm’s absorptive and adaptive capabilities

In the responses to the interview question which examined the challenges that businesses face when seeking to utilise new information from their internal and external ERP networks to improve their performance, most of the participants acknowledged major constraints that mar ERP optimisation to leverage a firm’s absorptive and adaptive capabilities.

Poor enterprise resource planning optimisation

From the businesses that use ERP, some of the operational managers admitted that most of the businesses tend to use ERP only for leveraging operational efficiency. In effect, as long as ERP is leveraging operational efficiency, initiatives are often not undertaken to consider how the enormous amount of information which is generated through ERP can be utilised to influence the performance of a business. In such an instances, some of the operational managers noted that the use of ERP is restricted as a mere monitoring mechanism. In such an approach, ERP data analysis is only undertaken to identify and correct deviating processes rather than as measures for assessing and identifying new information that can be acquired and assimilated to bolster a business’s overall effective market performance. Even if ERP reveals declining customer orders, sales and revenues, some of the operational managers noted that the corrective initiatives undertaken have often only entailed the use of simple strategies such as awarding coupons, price reductions and extensive advertisements to stimulate sales. In effect, the application of measures that identify new information that must be acquired and assimilated to aid the application of mega-strategies such as product modifications or the development of new products are often reserved only, for instance, where it has become apparent that the business is failing. Such a finding seems to resonate most of the responses to the interview question that

explored whether manufacturing firms frequently utilise their ERP systems to undertake the relevant data analysis and interpretation as part of the organisational culture. In such a response, one of the operational managers from the electronics manufacturing plant in Midrand stated that:

‘In most of the cases, ERP is regarded as a mere mechanism for enhancing effective coordination of activities. It is used as a measure for enhancing communication effectiveness and activities’ coordination rather than as a big engine for data mining to discern incremental improvement measures that can be adopted. In business, the emphasis is cost minimisation to the effect that if the product is still performing relatively well, the business often does not do much even if ERP data indicates symptoms of declining performance of the product. Incurring costs of product modifications or for developing a new product is an initiative that businesses are unprepared to undertake for as long as they are still able to scoop some profits from the existing sales and revenues.’ (Participant 1, 44 years, female, operational manager)

However, in response to the interview question that examined the challenges that businesses face when seeking to utilise new information from their internal and external ERP networks to improve their performance, some of the operational managers reiterated that it is not only poor information utilisation but also the integral linkage of the internal activities with the external networks that affects ERP optimisation. It was acknowledged that even if most businesses cherish the use and values of ERP, in many cases the use of ERP is restricted to only internal functional departments. In the application of this business approach, the ERP systems that most of the businesses have in place are only used for linking and integrating internal activities. The implications are latent in the fact that only limited and restricted linkage with the external partner organisations such as suppliers and customers are encouraged. Quite often, this approach is undertaken to limit the compromisation of internal business data and information. Such a finding is substantiated in the view of one of the operational managers from the gas manufacturing plant in Ekurhuleni, who stated that:

‘Our ERP system is mainly aimed at facilitating the efficiency of the internal activities. Hence, we use it for coordinating different internal activities as well as for undertaking the analysis of different internal activities. However, for analysing and tracking trends in the external environment, I think the business has not yet thought about that. In most of the cases, the analysis and tracking of the trends in the external business environment are done more manually by reading and interpreting media reports or instigating conversations and listening to customers and competitors. We do not use ERP in such analysis.’ (Participant 3, 39 years, male, operational manager)

In effect, it emerged from the findings that a dualistic state encompassing person-to-person interaction and hard paperwork vis-à-vis online accomplishment of different activities such as sourcing and processing and delivering customer orders tend to characterise most of the businesses that pride themselves as ERP averse. All these undermine the optimisation of ERP to acquire and assimilate new

information that would spur on a firm's absorptive and adaptive capabilities. Other challenges were found to arise from the cost of ERP implementation.

Cost of enterprise resource planning implementation

Costs of ERP implementation were noted to deter some of the businesses from investing in the establishment of ERP systems. It emerged from the findings that the costs of ERP hardware and software, as well as costs of consultants and ERP installation, limit investment in systems like these. Such cost challenges were mainly identified to hamper ERP optimisation in businesses with a lower net turnover. In effect, the findings revealed that such cost challenges explain why some of the businesses tend to have only the minimal elements in their ERP system. This view is substantiated in the opinions of one of the operational managers from the beverage manufacturing plant in Germiston who stated that:

'Although ERP is a desirable and a necessary system, its cost of implementation and maintenance is often a challenge for the less financially well-resourced firms.' (Participant 19, 28 years, IT operational manager)

Even if some of the businesses manage to commit the necessary resources on the establishment of relevant ERP systems, the findings revealed the challenge too often still arises from the cost of maintaining and upgrading the system. Because of such cost constraints, some of the operational managers argued that most businesses do not have effective systems maintenance and replenishment policies. In this approach, some of the businesses tend to adopt maintenance policies where maintenance and repairs are only undertaken after it is clearly evident that there is a system failure. This affects the level of ERP optimisation to acquire and assimilate critical information that would leverage a firm's overall effective market performance. Resource constraints were also mentioned by some of the participants to affect the development of an effective unit or department which is in charge of the accomplishment of relevant ERP-related activities. For ERP to induce the achievement of the desired business outcomes, the findings revealed that it must also have specialist staffs who are not only in charge of its functionality and maintenance, but also capable of ensuring that ERP is effectively optimised to accomplish different activities. However, in most of the cases, the ERP units, as well as the IT department are often understaffed with only a few staffs that are in charge of their maintenance. This affects the utilisation of ERP data and systems to undertake relevant analysis to discern the emergence of new information which may be assimilated for improving a firm's performance. Such a finding is derived from the opinions of one of the operational managers from the dairy products manufacturing plant in Ekurhuleni, who argued that:

'In our business, we use ERP to accomplish different analysis and interpretation of the available data. However, due to lack of specialist ERP data analytics staffs, we are unable to undertake such analysis quite frequently. We tend to only focus on important areas. This is because if undertaken unnecessarily,

analysis takes time and effort that may affect the involvement of the employees in the accomplishment of other activities. Specialist ERP data analysis staffs are therefore critical because in such cases, the business may not have to involve every employee in key areas in the analysis of relevant ERP information. Before we had such a system where employees in key positions were trained on how to extract data from ERP and undertake the analysis which were relevant for their positions. However, since employees keep leaving as new ones come in; training has not been conducted quite frequently to develop the data analytic skills for the new ones that come in. This has affected the optimisation of ERP in as far as the areas of data analysis and interpretations are concerned.' (Participant 21, 46 years, female, IT operational manager)

Such a finding implies that poor ERP optimisation often arises from the lack of funds that the businesses are able to commit to the training of the employees with the basic skills for ERP data analysis. Even if some specialist ERP data analysts are required for using more complex ERP data analysis methodologies, some of the operational managers noted that the training and development of employees with basic ERP data analytic skills improves the utilisation of the existing ERP data to improve different management decisions. As much as such constraints affect ERP optimisation to leverage a firm's absorptive and adaptive capabilities, it was still evident from the findings that ERP optimisation influences a firm's absorptive and adaptive capabilities.

Discussion

Enterprise resource planning system leverages the effectiveness of a firm's absorptive and adaptive capabilities. The use of the appropriate ERP technology creates an interface which facilitates a coherent internal system that seamlessly interacts with a business's external networks and external business environment. Depending on the management philosophy and organisational culture on ERP utilisation, this spawns acquisition and assimilation of the required critical new information. It is this interactive process of new information acquisition and assimilation that edifies a firm's absorptive and adaptive capabilities (Darroch 2010:4). New valuable information connotes critical new external data or knowledge that offers new insights on how a firm's internal capabilities can be improved. It also offers critical new knowledge on how it may tackle changes that emerging from the external business environment. New information that can improve a firm's internal capabilities may arise from the internally generated analysis of the ongoing processes of activities' accomplishment. As ERP's data classification algorithms aid the classification, comparing and contrasting of different groups, new information may also emerge from benchmarking with the other industry players. This enhances identification and assimilation of new best industry practices that are increasingly diffuse throughout the industry in which a business operates. This influences relevant reconfigurations and modifications of a firm's internal capabilities to a business approach or model that aids its ability to absorb and adapt to the emerging new changes.

Yet, as ERP facilitates interaction with different networks of critical business partners, suppliers, customer groups and logistics handling companies, it also aids the analysis, identification and acquisition of new information on the ongoing changes or likely probable future changes in market trends. Such changes may refer to new information that offers new insights on the shift in customer tastes and preferences. If such changes have shifted in favour of a business's products, its symptoms are often easily discernible in ERP systems. This may inspire the application of new incremental improvement measures to bolster a firm's overall production capacity, as well as its operational efficiency. This contrasts with circumstances where the emerging new information implies a shift in customer tastes and preferences in favour of rival products. In such circumstances, ERP uses data association algorithms to aid the analysis and acquisition of new information on whether the instigators of such changes are arising from the emergence of the declining market and industry attractiveness. It also discerns whether such changes are arising from the emergence of a new competitor that may affect a firm's performance.

The acquisition of such information enables a business to consider the strategies that can be conceived and applied to counter the risk of a decline in the attractiveness of the industry or the emergence of such competitors. In terms of the declining industry attractiveness, such new information may require businesses to consider the application of market development, product development, diversification or internationalisation strategies to absorb and adapt to such changes (Reeves & Deimler 2011:14). While risks of new competitors' emergence may be tackled using extensive advertisements and promotions, it may also require modifications of the features, attributes, designs and quality of the existing products or the innovation of new products if the business is to absorb the emerging changes and adapt to the overall increasing level of industry discontinuities and unpredictabilities (Coffman 2015:6). In other words, the interactive platform that is created by an ERP system not only links a business to its external business environment, but also enables businesses to stay abreast with the unfolding industry and market changes.

As businesses strive to stay ahead of competitors, ERP enhances the use of data clustering algorithms to segment competitors that are threats, as well as customer segments that must be targeted. Although this influences a firm's absorptive and adaptive capabilities, the proficiency of ERP systems to induce such advantages often still depends on the amount of resources that the executives are able to commit towards the establishment and maintenance of an effective ERP system. Enterprise resource planning system's leveraging effects on a firm's absorptive and adaptive capabilities are also determined by the level of a firm's optimisation of the information which is generated through ERP-facilitated business interactions and analysis. Unfortunately, findings revealed that these are often some of the major paradoxes that constrain the overall level of a

business's ERP optimisation. Certainly, this suggests that the issue of ERP system's optimisation to bolster a firm's absorptive and adaptive capabilities raises a lot of implications for the contemporary business managers and executives.

Managerial implications

To bolster ERP optimisation to leverage a firm's overall absorptive and adaptive capabilities, it is argued that the executives must commit the necessary resources towards the development of an effectively and efficiently functional ERP system (see Figure 1).

In terms of the internal capabilities, the development of such an ERP system would require the establishment of a structure which creates an internal business network that coherently integrates a firm's critical functional departments. Departments of this kind often consist of accounts and finance, personnel, marketing, procurement, production, distribution, executives and management, and asset management. Although partners in the external business networks evolve with time, the external business network that would leverage the effectiveness of ERP system's optimisation will have to consist of suppliers, customers, business partners and collaborators, financiers and government. Following the creation of these internal and external business networks, the establishment of an interface

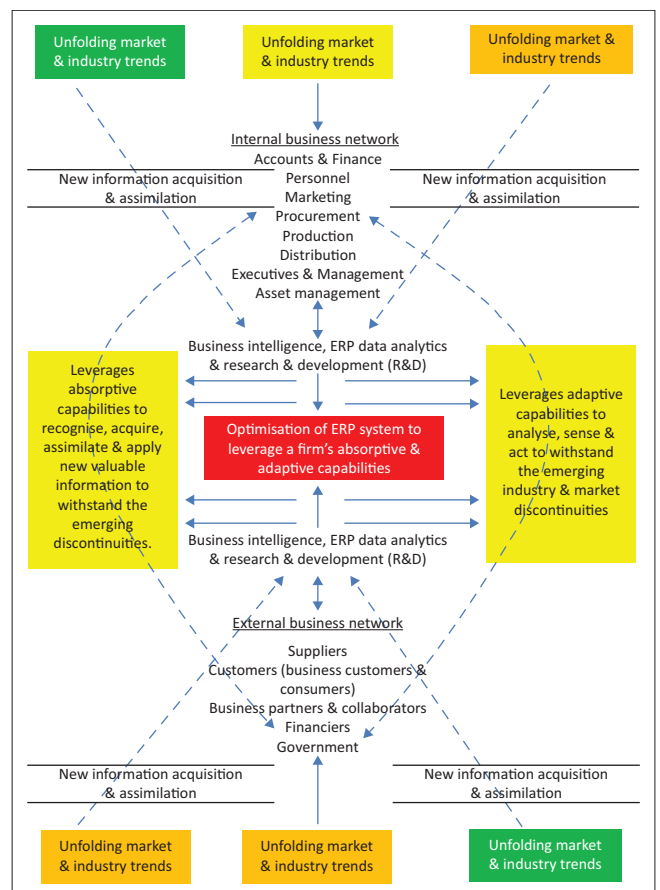


FIGURE 1: Optimising enterprise resource planning system to leverage a firm's absorptive and adaptive capabilities.

that facilitates interactions of these two networks is critical for edifying the effectiveness of the process of new information acquisition, assimilation and utilisation. However, even if the creation of such an interface bolsters new information acquisition, assimilation and utilisation, it is still critical that the entire ERP system is linked to the larger external business environment.

This aids acquisition, assimilation and utilisation of new information that is often not readily available among the external business networks of suppliers, customers, business partners and collaborators, financiers and government. To accomplish this, a firm's business intelligence systems and R&D would aid not only the analysis, acquisition, assimilation and utilisation of new information from the interactive interface of the business and its external networks, but also the acquisition and assimilation of new information from the larger external business environment. However, as such structured and unstructured data are obtained, relevant data analysis, using a combination of different data analytics algorithms, is critical for data association, classification and clustering to extract additional new information. Such an analysis offers insights into new knowledge that a firm's business intelligence system and R&D can assimilate to discern new relevant improvement measures that can be undertaken to consider the improvements which may counter threats. Such improvement measures may entail the integration of new best industry practices that are acquired from either critical networks of business partners or the larger external business environment.

Alternatively, it may also require strategy modifications, product modifications and even the development of new products to counter the changing market trends. As ERP system's optimisation aids all these, it bolsters a firm's absorptive and adaptive capabilities. Data acquisition and processing which are aided by a firm's business intelligence, data analytics and R&D catalyse a firm's absorptive capabilities to recognise, acquire, assimilate and apply new valuable information to withstand the emerging discontinuities. It also spawns a firm's adaptive capabilities to analyse, sense and act to withstand the emerging industry and market discontinuities. This is attributable to the fact that as a business struggles to survive in the midst of the turbulence in its larger external business space, the information generated through the interactive interface of different ERP system's components tends to offer readily available new information that can be utilised to create advantages that leverage a firm's survival and sustainability in the context of the unfolding market and industrial trends. As the interactive interface of ERP systems exposes enormous amounts of information about the unfolding market and industrial trends, the executives are able to undertake relevant data analysis to identify opportunities that must be maximised while at the same time also devising strategies to insulate the business against the unfolding threats. It is through such holistic processes that ERP system's optimisation leverages a firm's absorptive and adaptive capabilities.

Conclusion

Conventionally, ERP had been regarded in both theories and the pragmatic approaches adopted by different businesses as only critical for leveraging operational efficiency (Ghosh 2012:123; Shaul & Tauber 2013:9; Shields 2001:19). Theories on ERP data analytics also indicate ERP to aid data analysis and interpretation to acquire and assimilate new information that coordinate the various activities and operational efficiency (Better et al. 2007:477; Gordon & Linoff 2010:19). However, evidence on how ERP inspires the acquisition and assimilation of new information to enable a firm to create a strategic fit between its internal capabilities to the unfolding industry and market is not easily discernible from most of the previous studies. Yet, the extent to which a firm is able to modify its capabilities to respond to the emerging industry and market trends is critical to its continuity and sustainability (Teece 2007:131). In effect, findings of this research offer new insights on how ERP leverages a firm's absorptive and adaptive capabilities in the midst of the changing industry conditions to bolster its sustainability. In the midst of changing industrial and market trends, ERP leverages a firm's absorptive and adaptive capabilities. Improved absorptive and adaptive capabilities bolster a firm's capabilities to constantly acquire and assimilate new information to aid reconfiguration and modification of its existing internal capabilities to adapt to the emerging market and industrial changes. Even though some of the areas that the business must focus on are often easily discernible from the unstructured and structured raw ERP data, ERP still enhances critical data analysis using a combination of different data analytics methodologies. Using different operational process simulation and optimisation methodologies, this aids the extraction of new valuable information and knowledge that can be used to bolster a firm's overall operational performance. Such information and knowledge often offer new insights into how a firm can modify its operational approaches to unlock cost and efficiency advantages. These cost and efficiency advantages bolster a firm's cost competitiveness, as well as competitive differentiation in the midst of intense industrial competition. Enterprise resource planning also uses different algorithms that aid data association, classification, regression analysis and clustering (Hanumanth & Prasada 2014:5). This enhances not only the identification of the causes of threats that undermine a firm's performance, but also discerns the clusters of competitors and customer segments that must be targeted if a firm is to leverage its overall market competitiveness. Yet, as ERP aids the reading and tracking of the unfolding industry and market trends, it also enhances the acquisition of new information on the changing customer tastes and preferences, as well as the emergence of new innovations and competitors' actions.

As firms gain insight into such trends, ERP data offer valuable information on how the existing product development formulas can be modified to create points-of-difference that set the existing products apart from rivals. Enterprise resource planning also offers critical data that influence the development

of new products to respond to the emerging changes in customer tastes and preferences. All these are attributable to the fact that ERP creates a business system that leverages acquisition, storage, management and interpretation of external information and data to aid the extent to which a firm's is able to assimilate the emerging new external knowledge to adapt to the unfolding changes in market trends. Such a view seems to echo the definition of absorptive capabilities that measure a firm's ability to recognise, acquire, assimilate and to apply valuable new external knowledge in order to achieve the desired business outcomes (Volberda et al. 2010:931). It also echoes the definition of a firm's adaptive capabilities that connote its ability to undertake relevant analysis and sense the need to act by modifying its strategies, business models or products to respond to the unfolding industry and market trends (Hudakova & Misun 2014:3; Reeves et al. 2015:19). Certainly, this signifies that ERP plays a pivotal role in aiding a firm's absorptive and adaptive capabilities. However, how ERP optimisation inspires a firm's absorptive and adaptive capabilities had not been explored in most of the previous theories, this research used the business model shown in Figure 1 to offer new insights into how ERP can be optimised to leverage a firm's absorptive and adaptive capabilities. Even though such a model would bolster a firm's absorptive and adaptive capabilities, the limitation of this research arises from the fact that the effective application of such a model would depend on certain key success factors, such as management philosophies and the emphasis of a culture of continuous learning and development. In effect, future research should consider exploring the key success factors that would influence the successful utilisation of the ERP optimisation business model shown in Figure 1.

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Competing interests

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Authors' contribution

D.G. initiated the topic and did the literature review. B.O. did the primary research and analysed the findings and put the entire document together prior to submission to D.G. for approval and submission for review.

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