Utilizing enterprise systems for managing enterprise risks

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ABSTRACT

Enterprise risk management is a critical concept in the current business environment that supports use of tools and processes directed toward monitoring and mitigating organizational risks. Many organizations have embraced enterprise systems (ESs) technology for improving organizational efficiency and effectiveness. ESs provide value by identifying opportunities in operations and assist in managing risks through context sensitive analyses by eliciting relevant information. This research investigates how ES data were transformed into knowledge by a hi-tech manufacturing firm from an ES implementation, and how this knowledge was used to manage risks by utilizing an ES data transformation model from existing literature. Findings indicate that the ES data transformation process resulted from knowledge-leveraging actions at both executive and operational levels. At the executive level, the use of business intelligence module in conjunction with cascades of balanced scorecards helped in assessing progress for achieving goals, and translated decisions into risk-eliminating actions at the operational level. An initial technology-push approach assisted in creating semantically rich representative process models by simulating risk scenarios, leading to a strategy-pull approach for deploying business strategies and decisions. A value assessment strategic model articulates the knowledge-leveraging processes combining human skills with ES tools to optimize enterprise risks.

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1. Introduction

Enterprise risk management (ERM) is a vital concept in the current, volatile business environment that supports use of tools and processes, which provide naturally to data analysis for better managing risks and identifying opportunities. Organizational risks may include disrupted production in supply chain operations due to erroneous information, context-insensitive analyses, or a human error from oversight in task breakdowns. With the advancement of information technology (IT), software tools in ERM decision-support systems can be used to elicit data attributes into semantically rich representative process models by simulating risk scenarios, which assist in establishing knowledgeable decisions [1,2]. Since 1990s many organizations have implemented enterprise systems (ESs), also known as enterprise resource planning systems, to achieve integration of business activities and enhance organizational effectiveness [3]. ESs are packaged software applications offered by firms such as SAP and Oracle which allow organizations to procure them off-the-shelf and align them to their individual needs [4]. An ES usually supports in optimizing business operations and provides context-rich information to facilitate decision making and mitigate risks [5]. ESs enhance knowledge sharing within and across organizations assisting firms to access multiple viewpoints on long-term and short-term objectives optimally utilizing organizational resources. A successfully integrated ES can enhance operational efficiency by supporting a firm's business processes as well as create competitive advantages by enabling innovative practices [6]. Complex business processes can be mapped by decoupling different functional workflows to identify critical activities, which require monitoring to achieve business benefits. There have been quite a few studies to understand the critical success factors for ES implementations [e.g.,7–9] as well as many studies to establish the business benefits organizations obtain from ES implementations [e.g.,10–12]. However, there has been little research to understand how ES data are transformed into knowledge for decision-making, and how this leads to the benefits that mitigate organizational risks. “Very few studies have gone beyond looking at implementation to tackle issues related to longer-term usage and the impacts of these technologies on organizations” [13, p. 152]. This makes it difficult to draw explicit conclusions on the impact of ES on organizational performance [14].
The purpose of this study is to explore (1) how ES data are transformed into knowledge and (2) how this knowledge is used to realize risk-mitigating benefits. An ES data transformation model from existing literature is utilized to gain insights from an organizational perspective via a case study in a hi-tech manufacturing company. This company has deployed an ES for more than five years and so is in a mature stage of implementation. The results of this study, especially the insight gained from users–practitioners through the application of the transformational model, are useful to both academia and industry practitioners, which is a distinctive contribution of this study.

The paper is organized as follows. This first section introduced the focus of this paper with a brief background on enterprise risk management and enterprise systems. The next four sections review related literature, beginning with an analysis of ESs and risk management benefits followed by associated technologies such as knowledge management and business intelligence. The section concludes with the application of a model for ES data transformation into knowledge and results. The sixth section outlines the research methodology. The seventh section presents the empirical findings from a case study that applied the model in a hi-tech manufacturing organization. The eighth section discusses the results of the findings. Finally, the results are summarized and suggestions for future research are offered.

2. Enterprise systems and risk management benefits

ESs amalgamate a wider array of business automation tasks such as inventory management, sales order processing, financial accounting, production scheduling, materials planning, and supply chain management. These systems create data sources which provide valuable information to meet an organization’s business intelligence and knowledge requirements [15]. Having shared access to complete and accurate data, which can be tracked down to functional tasks, provides visibility and improves risk management capabilities. The key benefits that can be expected from post-ES implementation apply to both strategic and operational risks [16,17]. Some of the commonly recognized strategic risks that organizations face include selection of business partners, competitive positioning ability, future product versions and technological innovation capabilities [18–20]. The operational uncertainties that organizations may encounter are related to failure in delivering products on time, order-to-cash time management and account receivables, productivity and product quality issues, mismanagement due to non-standard company processes, and lack of real-time access to relevant information [21,22]. ESs provide value by identifying opportunities through operations and assist in managing risks by eliciting relevant information in exploiting and deploying strategies.

ERM is a systematic methodology for monitoring and mitigating risks holistically aligned to achieve organizational objectives [23]. This philosophy has become important in all aspects of organizational operations and is increasingly practiced by large enterprises in all industries across the globe [24]. It involves identifying and managing potential threats and applying future-focused strategies. It entails adherence to procedures using tools in creating the intelligence to evaluate optimal approaches based on insightful domain models. To achieve flexibility, adaptability, and risk management capabilities, the rules underlying the business processes are applied to assess organizational performance and ascertain health of the organization at different levels of granularity. Performance evaluation tools combine underlying data processes to provide management with a means to identify risks and yield better efficiencies [25].

Organizations gather data, simulate risk scenarios and apply information intelligence to make knowledgeable risk mitigating operational and strategic business decisions [26]. In the information processing view of knowledge, there are two key technologies – knowledge management and business intelligence – explained in the next sections.

3. Knowledge management

Knowledge management (KM) theories have emerged from a broad range of research fields such as sciences, economics and management. The diversity of these fields enables knowledge to be abstracted at different functional levels, allowing many viewpoints for understanding organizational knowledge, which is key for maximizing risk-mitigating benefits. KM is “the ability to selectively capture, archive, and access the best practices of work-related knowledge and decision making from employees and managers for both individual and group behaviors” [27, p. 6]. Over the last decade, KM technologies have evolved into the current technology-push approach moving toward the emerging strategy-pull approach. The technology-push approach uses the premise that knowledge can be pushed to the right people at the right time with the use of technology. Whereas, strategy-pull approach represents organizational methods that combine data management systems like ESs with the creative and innovative capacity of human beings to develop and enhance knowledge intensive business processes [28]. Both approaches guide users in exploiting knowledge of application semantics with their experience and expertise through suitable tools to manage risks.

4. Business intelligence

For driving business collaboration, organizations necessitate data management and the intelligence to evaluate specific data objects and establish informed decisions. Business intelligence (BI) is an activity that supports transformation of data into valuable information, insightful analysis leading to knowledgeable action. Over the years, BI has become a top “business priority” against being a top “technology priority” earlier [29, p. 1530]. It is described as a rational approach to management, which is fact-based and analysis-based, converting data into information, and empowering organizations to “make better decisions faster” [15, p. 14]. BI supports collection, analysis and reporting on organizational data in all of the business activities supported by the system throughout the value chain [30]. BI focuses on extraction and analysis of structured enterprise data with dissemination of results whereas content management relates to management of the unstructured corporate data to make it meaningful. An ES enables this point of convergence and constitutes an important aspect for organizational knowledge creation since it is the fundamental risk management tool in the intelligent enterprise [31]. Management decisions are made based upon the explicitly structured organizational domain data that are analytically assessed in combination with corporate strategy.

5. A transformation model for assessment of benefits from an ES implementation

A model conceptualized by Davenport for evaluating the process of ES data transformation into knowledge and results is shown in Fig. 1. The model comprises three major stages. The first is establishing the context. This includes the pre-existing factors – strategic, organizational and cultural, skills and knowledge, data, and technology – that must be present to achieve successful transformation of ES data into knowledge and results. The second stage is the transformation of ES data into knowledge that takes place when the data are analyzed and used to support a business
decision. This is the stage where the strategic and organizational risks are evaluated for mitigation through the analytic and decision making process. Process variables are evaluated objectively with ES data to analyze risks, control input resources, and decide actions. The final stage is the outcomes, which describe what changed as a result of implementation of the decisions.

Davenport [5, p. 255] notes, “it may be difficult to draw a direct chain of influence from prerequisites to transformation to non-financial outcomes to financial results, but establishing that linkage should always be the objective of an organization that invests effort and resources in ES data transformation”. This study demonstrates how the transformation process impacts business processes to produce risk-mitigating benefits within an organization.

6. Research methodology

In this research, the assessment of risk-mitigating benefits from an ES is conceptualized as a series of steps that begin with identification of risks and conclude with realization of benefits. The stages mirror the typical analytical and decision-making process. Using a qualitative research methodology, data were collected by way of semi-structured interviews with key respondents in an organization that has implemented an ES. A single case study has been used focusing on the deeper dynamics of ES deployment to reveal practice knowledge used by a mature organization. The case of ES implementation was selected with a predetermined criterion that the organization should have implemented ES for at least three years and so is in the mature phase of realizing benefits. The participants included senior executives, managers and operational staff in the organization. Nine face-to-face meetings between 50 min and 3 h each took place at the organization. The positions of the participants included: manufacturing director, operations and supply chain (O&SC) manager, purchasing manager, IT manager, finance controller, and quality manager. Due to the seniority and experience of the respondents, the interviews exemplify and demonstrate in-depth the post-implementation usage of ESs to better establish knowledge leveraging processes used for mitigating perceived risks.

A research information sheet and the interview questions were sent out to the respondents prior to the interviews. In the interview, questions were asked to gain insights on how evolving ES data are extracted from structured database and converted into semantic information exchanges to make intelligent knowledgeable decisions for enhancing risk-mitigating benefits. The interviews were tape recorded and transcribed immediately after each interview. The Nvivo 7.0 qualitative software tool was used to code, categorize, and support evaluation of interview data. The software efficiently integrates and manages processes to search, index, and theorize unstructured and nonnumeric data. Text data matrices were created for comparison as well as visually mapping categories was identified for analysis. Davenport’s model (Fig. 1) provided the methodological guidance into the data collection and evaluation of the study. The empirical findings were analyzed and the inferences reported.

7. Case study findings

Cevon (a pseudonym) is a successful high-tech manufacturing business based on global positioning system (GPS) technology. Specifically, Cevon is involved in the design and manufacture of electronic devices used in marine applications, personal in-car navigation and wireless fleet tracking at their manufacturing plant in Auckland, New Zealand (NZ). Established in 1987, by 2002 Cevon had grown from seven employees to 250 with annual revenue of more than NZ$100 million. Since 1998 Cevon had been using SyteLine version 5 from Mapics as their business management system. However, as the company grew globally, the collaboration and communication between their subsidiaries and distribution centers in all major parts of the world required improvement. In 2006, Cevon upgraded to SyteLine 7 (SL7) in the main manufacturing and R&D site in Auckland and was live by January 2007. The new SL7 system has a user-friendly GUI, Windows-type environment, and additional features such as Web-based access for better connectivity. The scope of the implementation included the standard SL7 with all existing functionality from SLS plus a new chart of accounts, advanced planning and scheduling (APS), business intelligence Cognos Impromptu and Powerplay, and workflow modules. In 2004, Cevon was sold to US Corporation (a pseudonym) who managed
the business with substantial financial support. US Corporation grew Cevon to become a N$500 million business with 750 employees. The interviews took place in 2008–2009 when Cevon had become stable after the US Corporation takeover. The empirical findings are described using the format of the transformational model (Fig. 1) to investigate the process of ES data transformation and benefit realization at Cevon.

7.1. ES data transformation process

The ES data transformation process at Cevon is the result of making knowledge-leveraging actions at both, operational and executive levels. At the operational level, the ES is used to monitor day-to-day transactions in running of business functions such as sales and distribution, production planning, materials, and financial management. Monitoring produces a surfeit of detail about functional processes, which are then aggregated into metrics to provide an overall picture. Metrics provide the necessary risk-monitoring infrastructure for thoroughness and completeness in activities which further assist in decision making and corrective/preventive actions. At the executive level, Cevon has created the linkage between the metrics for various process variables to manage the company’s risk mitigation strategies and setup key performance indicators in each functional area. The risk framework has been translated into team-based departmental plans leveraging improvements to achieve the defined goals and objectives. The plans identify metrics for each key performance indicator (KPI) against which major processes are aligned. These are communicated to all the team members and their specific key result areas are monitored. The trends emerging from each indicator are evaluated to support inter-functional and overall business decisions.

7.1.1. ES data transformation into knowledge

Findings reveal the use of various ES functionalities and business tools to transform ES data into knowledge. The methods include use of standard and custom ES reports, forms, and user-friendly queries to answer specific questions. Special reports are created through the use of Crystal Reports functionality in SL7. The IT manager explained that the ES implemented by them, namely SyteLine (also referred as SL7), has “a lot of data in its database and it is not always presented in a user-friendly manner”. Therefore, Cevon uses a bolt-on business intelligence application called Cognos Impromptu, which allows a more user-friendly way of drilling into specific data objects and presenting queries and reports with precise information in a format that the user can easily relate to. The BI tool provides representative modeling views of various process activities and improves understanding of functional task flows. The manager further noted that the BI tool is good for generating ad-hoc reports by users. There is no need for the user to go to a developer and request a new report layout because a particular column that the user wants in the report is not there. So, there is a cost saving as well. This application is quite useful to users who need to create improvised reports based on the challenges they face in day-to-day business. The tool helps to get required data out of the system quickly and efficiently. The manager explained that when users have the ability to access the data easily they could quickly build a picture of relevant information and make better decisions. The BI tool insulates the user from the complexities of the embedded database, letting the user focus on high-level reports for analyzing uncertainties and risk scenarios. It presents a multi-view of the information and enables users to forecast with current data in different contexts. The data access by users is controlled via the user permissions set.

SL7 allows the recording of actions that are being taken throughout the organization in the form of various transactions such as customer order receipt, purchase ordering, order invoicing, stock movements or payments to suppliers. This information is accessible by a range of users and it is fixed. The IT manager stated, “there is no ambiguity, it is a record in the system and everybody sees it the same way. So, it is like an information provider that allows all the different functions to make whatever decisions they need to make to keep the business running. It does not make decisions for the people but it provides the information for the people to make a decision and is consistent. It does not matter where the user looks at and how big the piece of data is. It is not realized often, just gets engrained in the culture of the company but many people use it as their source reference point for the daily business decisions that they make”. The BI is not the only reporting system at Cevon. There are a number of standard reports that are built in as part of SL7, as well as some custom reports that have been built specifically for Cevon and added to existing SL7 reports. The data in SL7 are relatively easy to access, according to the IT manager. The operations and supply chain (O&SC) manager however opined that SL7 functionalities could have been further enhanced with some more reporting utilities (e.g., colorful graphs, more formulae applications) for better estimations, although the respondent was appreciative of the current BI reporting methods. Cevon has also implemented a SL7 data warehouse, wherein specific data related to customer orders, inventories, and finance are collected from the various subsidiary sites through file transfers each night. The data are mined, collated, and the information is made available to users who have permissions to log into the data warehouse. Additionally, Cevon staff also use a SyteLine Viewer application that provides a read-only view of SL7. To use the SyteLine Viewer application the user does not log into the main system, therefore a user license is not required. The application has in-built queries that provide real-time information based on the user requirements as explained by the O&SC manager. Overall, the O&SC manager considered their current system effective for extracting and analyzing data for improved data visibility and decision making.

7.1.2. Utilization of knowledge for decision making to achieve risk-mitigating benefits

Cevon has been utilizing information from SL7 to provide a view of organizational performance as projected through cascades of balanced scorecards. The scorecards present the measurement of current status of functional performance areas, drilled at various levels of granularity. They highlight the company’s objectives and provide a quantitative analysis through standard metrics, defined by the managers, to identify gaps or issues toward achieving those objectives. This includes benchmarking the KPIs and monitoring performance against the benchmark on an on-going basis. The scorecards also include the specific names of the persons responsible for achieving the objectives with target dates. Decisions are then taken based on the analyses, interpretations and the knowledge outcomes. Keeping the scorecards relevant is an on-going task, especially as each business unit grows. The manufacturing director noted “it would be very beneficial to have multi-scorecards for the business that track some of the key performance indicators for separate business units and make sure things are happening. The interesting features from the scorecards were to know what the budget was for the next six months, what were the firm orders, the planned orders, what were the gaps [risks], where were the gaps coming from, and from which regions. So that the gaps could be taken up with those regions to ask for example, they had forecast for two million dollars and already had firm orders of 1.6 million, so where was the balance four hundred thousand going to come from. Those sorts of things, to make sure that the budgets are being met and providing visibility to all concerned especially the salespersons in the regions to make them aware of the status”. 
Digital dashboards are another method for utilizing information and knowledge sharing at Cevon. The dashboards are a graphical representation that the executive management team uses to track the performance indicators to evaluate which areas are performing well and which ones are not. Each component of the dashboard represents a different function of business activity, such as monitoring a revenue forecast. A digital dashboard helps management to view a detailed picture of the organization's performance and to better understand areas of deficit, which are potential risks. According to the finance controller, if the right data are retrieved and the noise eliminated, then correct decision making becomes a lot easier because the objects that are disrupting the picture have been removed. This allows for clear and accurate decision-making. Analytic modeling is performed using external systems where the extracted data are transferred into spreadsheets for analysis. The analytical assessments help to establish metrics using a number of different performance indicators. "We're looking at KPIs from order-to-cash, so that KPIs from every business process between taking an order from a customer, delivering the goods and collecting the money can be clubbed together in a one page document which would really be a statement of how the business is performing at any point in time. The true benefits of this are not from knowing any one week's performance but from knowing week on week whether the performance is getting better or worse. This is where such analytical information gets beneficial if the effect of changes is evaluated to understand whether the changes have actually been worthwhile. The scorecards can provide the reassurance that the kind of changes the company is doing are actually resulting in measurable benefits." At different times the SL7 administrator at Cevon has been asked to help produce information from the ES that is used for evaluation of some KPIs. It has only been a matter of establishing what that indicator is and what drives that indicator which really is the vital imperative. Once that is established, the required process variable is easily retrieved out of the system, measured, and monitored to improve the process. According to the O&SC manager, "KPIs need to be monitored continuously and with digital dashboards we can review KPIs under different contexts by consolidating or drilling-down data". The O&SC manager explained that different people are interested in different types of KPIs in different areas. But, what everybody wants to know are the risk-evaluated results. The system is used to be analytical in terms of being able to assess results, whether the company is getting better in particular risk areas or worse. Or what is the result of making a process change. The O&SC manager expressed that change in a particular process needs to be analyzed to see whether it is having a positive or a negative effect on a range of different KPIs.

7.2. Data transformation benefits

The result of data transformation and utilization of ES information has led to improved outcomes at Cevon at both operational and executive levels. At the operational level, several outcomes in areas of sales forecasting and operations planning are explained next. This is followed by executive level outcomes.

7.3. Operational level benefits in sales forecasting and operations planning

Customer orders for Cevon are mainly made up of confirmed and forecasted orders received via subsidiaries. In the sales forecasting and operations planning process, the aim is to have all orders for the next three months firmed up and forecasts reviewed for the subsequent three months with the customers. Prior to SyteLine implementation and BI tools, the sales forecasting and operations planning process lacked data support and so the review process was inadequate. With the new system, the planners started generating a six monthly forward order status report by region from SyteLine using BI. This became the founding point of Cevon's manufacturing rolling plan. The forward order status report is emailed to all subsidiaries and regions with a request to firm up the next three months demand and review following three months forecast based on inventories and their market requirements. This process is repeated each month using the BI system, which streamlines the demand planning with subsidiaries. As a result, the materials and capacity plans are regularly updated and adjustments to the procurement and manufacturing plans are automated through the material requirements planning (MRP) module of SL7 reducing the uncertainties and risks of delivery failure the company faced earlier. This new rolling plan process has not only improved inventories, but also the factory capacity and scheduling, leading to improved delivery performance and customer service. The O&SC manager stated "the use of APS (advanced planning and scheduling) functionality has made a major change in achieving accuracy in the planning process". Earlier Cevon lacked information support and ran the risk of being able to accurately promise delivery dates to customers. In the revised process, based on the demand quantity, an ATP (available-to-promise) is requested from the system. This is done while entering a customer order or a forecast with the customer's requested delivery date. As explained by the O&SC manager, an ATP executes a planning run for that specific order line and informs acceptance of the requested date or provides an alternate date with a report on the delay. The user can drill down to review the bottlenecks, and understand the reasons for the delay such as either component receipt dates are causing the problem or the availability of capacities or resources. This information is used to communicate with purchasing and manufacturing to review possibilities for improvement in meeting customer demand. Additionally, an automated order verification report has been introduced which is emailed to the customer, confirming the delivery date with all other relevant details of the order. Another, customer overdue report is introduced in this area that has helped in improving customer service.

SL7 synchronizes production with available materials and customer demand to create planned orders. The jobs are created from the Planner Workbench functionality with start and finish dates. The scheduler sequences these jobs against the resources based on the rules set such as "minimize set up". The output of the scheduling is the allocation of resources against the jobs based on the schedule and sequencing rules and the current operations that provide an optimal plan. The new planning process through SL7 allocates resources. It indicates how much and when a resource is required. Based on this SL7 working "as soon as a salesperson enters a customer order, the order is planned after the next planning run and has allocated capacity according to the routing that has been set up. As the capacity is planned there are various options that are available to represent the data back to the user. This includes capacity graphs by resource and resource group for a chosen time period and bucket. Armed with this information, a call can be made whether additional shift/labor would be required for the forecasted work". In summary, the SL7 planning process provides forward risk-mitigating visibility of planned orders and the impact on capacity, assisting planners to analyze both historic and forward sales figures. The planners can review overdue customer orders, analyze the delivery performance, and evaluate reasons for any delays.

7.4. Executive level benefits

A value assessment model has been developed for senior management through graphical tools using balanced scorecards and digital dashboards. The model clearly defines the business activities that add value for its customers in each of the functional
areas aligning company resources and future plans with risk-mitigating strategy. For example, the system includes a review process that provides the means for a response through assessments supported by the underlying BI and data warehouse application. These assessments are performed in areas of (1) production yields and output, (2) cost and quality parameters, (3) manufacturing and test equipment utilization, (4) planning and delivery targets, (5) inventory levels, (6) R&D plans and deliverables, and (7) financial results against benchmarks. A dashboard for each of these functional areas highlights KPI status reports to provide risk-avoiding information such as an overview of quality measurements per production batch lists with acceptance/reject rates, scrap, first time pass yields and rework costs. Operational measures highlight metrics such as inventory stock turns, unplanned downtime, on-time delivery to customers, and warranty returns to avoid risks of high inventory, late customer deliveries, penalties, and warranty costs. Control tactics specific to corporate business rules highlight deviations such as resource allocations and downtimes. This has enabled the company to increase operational efficiencies, maintain high product quality, and achieve higher sales and customer services. Establishment of dynamic analytical processes however, is a recent development at Cevon to improve performance and realize risk management from their ES investment.

8. Results and discussion

In answering the first research question, how are ES data transformed into knowledge in seeking risk-mitigating benefits from an ES, the extensive use of ES functionalities and business tools have emerged from this study. The major methods include representative models employing standard and custom ES reports, forms, and user-friendly interfaces for writing queries. Additionally, data warehouses are used when cross-functional data are brought in from various heterogeneous environments and the ES users utilize the relevant information on a regular basis. Tools such as SyteLine Viewer, which do not require a user license, are utilized so that more staff can access read-only data cost-effectively. Organizations also use special reports created through the Crystal Reports functionality in SL7. The BI module helps to perform user-friendly queries, execute formatting commands, and report on particular data objects to provide a more informed view. This application assists users who need precise and prompt information for the day-to-day running of the business as well as analytical evaluation for implementing strategies. Two-dimensional data objects are transferred to Excel spreadsheets where further data manipulation is performed. In this manner, the analytical processes enable ES data transformation into knowledge assisted by different contexts – strategic, organizational and cultural, skills and knowledge, data, and technology – of the transformational model (Fig. 1) driven by set benchmarks and key indicators in day-to-day operations. The knowledge extracted through the analytic process provides the background for making decisions that optimize business risks.

The second research question – how is ES knowledge utilized to make business decisions for the realization of risk-mitigating benefits – emphasizes that decision-making processes in organizations should be on the basis of well-analyzed, high-quality current data that are aligned to achieving risk-managing business goals. Cevon uses various knowledge-based processes to aggregate ES data into appropriate metrics, apply human judgment and experience, and use the created knowledge for improved decision making. The information is made available by the use of standard business analytics and ES reporting tools within the system. The ES data are transferred into Excel spreadsheets to facilitate detailed analyses whereby users can create graphs, pivot tables, and other user-friendly representations. The business decisions are established on the basis of data analysis and other organizational factors. Cevon also uses benchmarking and KPI reporting supported with ES data for measuring and monitoring performance to achieve risk-optimized goals and targets. The performance review process leads to decision making that helps in achieving the overall business strategies. Additionally, business tools such as balanced scorecards and dashboards are used to track progress toward realizing risk-allaying benefits and establish analytical decisions. The relevant information extracted through the ES business intelligence engine makes management aware of issues and gaps in different business activities as they arise within the value chain. Wu and Olson [24] have also recognized the use of business scorecards to support risk planning. Scorecards are suggested as a successful approach that include measurable and build into the decision support system in order to monitor performance of the enterprise in the “strategic decision analysis” [24, p. 362].

The benefits of data transformation result in improved outcomes at both operational and executive levels. From this study, some of the operational level benefits include better sales forecasting and operations planning which streamlines the demand planning and inventory management process as well as improved scheduling of production in the factory. Use of generic and customized reports further improves the analytical decision-making process enhancing operational efficiencies. Additionally, use of ES advanced functionalities such as APS, ATP, Planner Workbench build in accuracy in the planning process, optimize production capabilities, and lead to an enhanced delivery performance mitigating risks of delivery failure with better service to customers. The process provides visibility of planned orders and reveals impact on plant capacity assisting planners to analyze both historic and forward sales figures. The planners can review overdue customer orders, analyze delivery performance, and evaluate any delay risks. Benefits at the executive level include a performance review process that provides the means for a response through assessments supported by the underlying BI and data warehouse application. These assessments are performed in key areas such as production yields and output, cost and quality parameters, manufacturing and test equipment utilization, planning and delivery targets, inventory levels, R&D plans and deliverables, and financial results against benchmarks. A dashboard for each of these functional areas highlights KPI status with instant reporting to the executive team for analysis and decision-making. Different data objects can be condensed or consolidated to monitor performing and non-performing areas. Wu and Olson [2, p. 646] have proposed a simulation approach utilizing enterprise data to allow decision makers to perform “trade-off analysis among expected costs, quality acceptance levels, and on-time delivery distributions”. This also assists to “evaluate and improve supplier selection decisions in an uncertain supply chain environment”. According to Davenport [5], some companies are beginning to link decisions to the data and knowledge used to assist them, but this linkage is not a common one. “If the results of ES data transformations are not used to inform decisions, then what is the point of the transformations in the first place?” [5, p. 224]. Some of the critical ES practices for managing enterprise risks are summarized in Table 1.

Table 1 highlights how organizational practices are augmented with ES deployment to represent a technology-push approach that pushes knowledge to the right people at the right time, however leads toward the strategy-pull approach. The integrated organizational methods with the use of ES technology develops and enhances knowledge-intensive business processes that assist in identifying and seizing strategic opportunities driven at both the executive and operational levels to manage risks and maximize
benefits. The findings from this study confirm Davenport’s contextual factors – strategic, organizational and cultural, skills and knowledge, data, and technology (Fig. 1) in explaining the ES data transformation process and risk-mitigating benefits. The process outcomes lead to increased employee motivation enhancing new initiatives and process improvements that eventually lead to financial impacts. However, in a world of constant change, companies must recognize need for constant review and revision. The ES data transformation process, therefore, is not a one-time activity starting from the context phase and ending with risk-mitigating benefits. This is an on-going process of continuous improvement, as firms learn from experience reducing organizational risks over time.

9. Conclusions and future research directions

Several key findings have emerged from this study. The research has examined the effectiveness of ESs on organizational functions and processes for achieving risk-mitigating benefits. The study has provided an increased understanding of the various knowledge-leveraging processes organizations adopt in use of ES and its information for managing risks. The study highlights that results follow when risk-mitigating strategies are clearly articulated and defined. A value creation process is developed identifying the critical areas that require attention and improvement. The business managers continually monitor the key performance indicators through ES reports and measure them against benchmarks. Executive team translates their overall risk managing strategies into departmental or divisional strategies, know what targets to achieve, which data need further analytical application, and expected outcomes. For achieving all of this, the organization must possess the necessary expertise and skills in ES usability.

The main contribution of this research lies in providing methods used in ES data transformation processes and its implications for both research and practice with a focus on usability of an ES at both operational and executive levels. The implications for practitioners are clear. Identification of project goals and objectives helps bring clarity into the expected outcome, and then the ES data transformation process for achieving the objectives becomes easier to achieve. Also, tools for data extraction and analytical processing are essential to support the ES data transformation process. Using the transformational model in this study, the linkage between data transformation and risk-mitigating benefits has been demonstrated to offer rich insights on how ES data are used by management teams for improving effectiveness and realizing organizational objectives. The findings from this research are limited to the views of nine professionals interviewed in one organization. However, the study’s conclusions are drawn from interviews with a diverse set of professionals with considerable seniority and experience and positioned in a key firm in the hi-tech industry.

Based on the results of this study, it is suggested that this study be replicated using a diverse selection criteria of organizations such as selecting small organizations, or a different industry sector such as retail or service industry where ES implementations are realized. The perspectives of ES users in those organizations can be explored to understand their ES data transformation processes for managing organizational risks. Thus, future research would analyze the critical effectiveness constructs used by other organizations in different sectors to investigate their perspectives and experiences and compare the findings with this study. Similar studies could also be conducted in other countries to better understand the management of enterprise system technology for enhancing risk-mitigating benefits.

References


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