Industrial Management & Data Systems

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Technological, Organisational, and Environmental drivers for enterprise systems upgrade

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Received 30 September 2015
Revised 14 December 2015
19 February 2016
Accepted 21 February 2016

Abstract

Purpose – Enterprise systems (ES) upgrade is a complex phenomenon, yet it is possible to reduce the complexity through understanding of the upgrade drivers. The purpose of this paper is to investigate the various upgrade drivers, in order to provide a detailed understanding of the factors driving upgrade decisions.

Design/methodology/approach – This research is grounded in a qualitative survey design. It utilises a web-based survey questionnaire and semi-structured interviews to collect data from 41 respondents representing 23 large organisations. The data were qualitatively analysed and coded to identify the various drivers and their influence on ES upgrade decisions.

Findings – The findings suggest that the upgrade decisions are dependent on establishing the need to upgrade, which is influenced by various drivers and stakeholders interests. In addition, the findings suggest that organisations would only opt to upgrade when benefits are aligned with the upgrade and when the decision makes business sense.

Research limitations/implications – In this paper, the authors propose that there is a relationship between the upgrade drivers and the upgrade strategy. However, qualitative studies can only formulate logical generalisations. Hence, future research could explore these associations through a quantitative study in order to provide probabilistic generalisation that offers either similar or conflicting arguments applicable to ES upgrade phenomenon.

Originality/value – This paper provides an alternative classification of upgrade drivers, and conceptualises an association between upgrade drivers and the upgrade strategy, which in turn facilitates minimising disruptions and upgrade risks.

Keywords Enterprise systems, Qualitative survey, ES upgrade, Systems upgrade, Upgrade drivers

Paper type Research paper

1. Introduction

Enterprise systems (ES) upgrade is a continuous process in which organisations can take advantage of features and functionality that result in performance improvement, reduction in maintenance effort, and increase in capability to re-examine and automate business processes (Leyh and Muschick, 2013). However, few organisations opt to upgrade their systems in a timely manner. Dempsey *et al.* (2013) suggest that such decision could be associated with the organisation's need to understand the benefits and evaluate the reliability and stability of the new version. This hesitation implies that organisations utilise outdated systems and risk losing continued technical support and may lead to increased operational overheads and performance bottlenecks. On the contrary, Ng and Wang (2014) suggest that upgrading is a complex undertaking with a tendency of disrupting operations and running over budget. The complexity is not eased by the fact that upgrades are recurring throughout the system's lifespan, at least

This paper was presented at the 19th Pacific Asia Conference on Information Systems, Singapore, 6-9 July 2015.

Industrial Management & Data Systems
Vol. 116 No. 8, 2016
pp. 1636-1655

0263-5577
DOI 10.1108/IMDS-09-2015-0407

once every two years (Zhao, 2007), which normally result in huge investment costs (Dempsey *et al.*, 2013).

To date, research on ES upgrade offered practical guidance for managing and supporting upgrade projects, with several studies offering valuable insights into upgrade factors. However, most of these studies focus on enterprise resource planning (ERP) systems or a single system from one vendor. Hence, there are several calls (see Claybaugh, 2010) for more research to explore other upgrade drivers or possibly examine if the upgrade drivers differ between vendors and/or systems. This implies that most of the existing studies are offering a fragmented view on whether similar drivers would influence upgrade decisions in the context of the whole ES landscape. Furthermore, Paradonsaree *et al.* (2014) and Scheckenbach *et al.* (2014) suggest that research on upgrades is scarce. Hence, this paper investigates ES upgrades focusing on the drivers, in order to contribute new insights by addressing the following question: what drivers influence organisations to upgrade their systems, irrespective of the type of system within the ES landscape? It is anticipated that through answering this research question, it would encourage organisations to gain better insights of ES upgrade in order to understand when to take advantage of upgrades to support strategic plans and improve overall business performance while minimising disruptions and upgrade risks.

This paper is organised as follows: the second section provides a general background and overview of ES upgrade and discusses some of the findings from earlier studies. The third section outlines the methodology adopted in this study. The fourth section presents and discusses the findings and their implication on ES upgrade and draws relevant conclusions by relating these findings to the existing body of knowledge.

2. ES upgrade overview

ES has been interchangeably referred to as ERP; however, Davenport *et al.* (2004) suggest that ES and ERP are different. In fact, it can be argued that ES constitute a variety of systems including ERP, customer relationship management, supply chain management, and so forth to provide a complete overhaul of the transactions processing systems landscape (Markus and Tanis, 2000; Shang and Seddon, 2002). Ward *et al.* (2005) substantiate this explanation and describe ES as a comprehensive, configurable, and integrated suite of systems and information resources, which support organisational-wide operational and management processes. Thus, in this paper, we adopt the definition offered by Ward *et al.* (2005) and suggest that the suite of systems within an ES enable integration, collaboration, interaction, and support the organisation's processing needs.

According to the market survey results by Panorama (2014) cited by Ng and Wang (2014), very few organisations tend to realise the full potential of their ES. According to Voulgaris *et al.* (2014), the actual ES value becomes visible and realised after the system "go live", a period referred to as post-implementation phase. Several stages have been proposed as part of the post-implementation phase to support organisations to manage their systems effectively and efficiently. For example, the ES life cycle definition from Motiwalla and Thompson (2009) offer four stages that are stabilisation, backlog, new module, and major upgrade as part of the post-implementation phase. The backlog stage deals with modification development, evaluating new requirements and processes to support business needs. The new module stage extends the implemented system with additional capabilities to support the existing processes and improvements in performance. The major upgrade stage focuses on extending and expanding the existing systems depending on business needs and keeping pace with the vendor's version release cycle. Based on this definition by Motiwalla and Thompson (2009), this paper focuses on major upgrades and refers to it as upgrade.

Upgrading is an important aspect in the systems lifespan that ensures continuous improvement and stability of the system (Hecht *et al.*, 2011). Vaucouleur (2009) defines ES upgrading as a process that intends to expand the existing system's core capabilities by improving functionality and taking advantage of new technology features, offered in a new version. Ng (2011) defines upgrading as replacing the existing version entirely or partly with a newer version from the same vendor or different vendor. Both these definitions suggest that upgrade results in functionality improvement when compared to the current installed version. It can also be stated that there are two upgrade dimensions: version-to-version upgrade and system-to-system upgrade. Version-to-version upgrade implies that the current installed system is replaced with a newer version of the same system from the same vendor. While system-to-system upgrade means that the currently installed version is traded with another system altogether possibly from a different vendor. According to the explanation from Seibel *et al.* (2006), with frequent release of new versions, it is possible that organisations opt to undertake version-to-version instead of system-to-system upgrade, as they are familiar with the system capabilities. Therefore, we position our study as an investigation of version-to-version upgrade drivers.

Although major ES vendors offer strategies, methodologies, and best practices to manage and support upgrades, many organisations employ informal strategies when contemplating upgrading to the latest ES version. Therefore, the fundamental questions to ask during upgrade decision making is when to upgrade, and this is normally influenced by "availability of a suitable version", "the customer's need for upgrade", and "economics" as specified by Kankaanpää and Pekkola (2010). It is understood that several drivers (Table I) influence the customer's need to upgrade.

Khoo and Robey (2007), Otieno (2010), and Dempsey *et al.* (2013) all categorised the upgrade drivers identified in their respective studies as either motivating or inhibiting upgrade decisions. The motivating factors positively influence the organisation to upgrade their ES, such as new functionality, business needs, and continuous vendor support. The inhibiting factors that cause the organisation to not consider upgrading their systems include costs and availability of resources. Claybaugh (2010) identifies drivers from existing IS literature and classifies them into three contexts: technological, organisational, and environmental. Based on responses from 190 experts, Claybaugh analyses the influence of these factors on the decision to upgrade. However, Claybaugh (2010) only focuses on a single-vendor "SAP" and a single-system "ERP". As each system within the ES landscape is implemented for a specific purpose, there is a huge possibility that the drivers that influence upgrade decisions can be different between systems and vendors. This could be the reason Claybaugh (2010) suggested that further research is required to explore factors that influence upgrade of other systems from same or different vendors. Additionally, generic strategies could be established when organisations understand what drivers influence upgrading their entire ES landscape. Hence, this study attempts to understand and identify what motivates organisations to upgrade their current ES version, with the aim of identifying common drivers within the ES landscape. Therefore, the outcome of this study would either extend the drivers proposed by Claybaugh (2010) and (or) provide some indication if similar drivers are influencing upgrade decision across the entire ES landscape.

Table I. Factors influencing upgrade decisions

	Articles						
Reasons for upgrading	Seibel *et al.* (2006)	Khoo and Robey (2007)	Vaidyanathan and Sabbaghi (2007)	Roberts (2009)	Claybaugh (2010)	Otieno (2010)	Dempsey *et al.* (2013)
Continuous vendor support	X	X	X	X	X	X	X
Technology advancements	X	X	X		X	X	X
Technology obsoleteness	X			X			
Maintenance cost		X	X		X	X	X
Improve usability		X	X	X		X	X
Standardise functionality	X	X			X	X	X
Improve decisions capabilities	X			X			
Benefits realisation	X	X	X		X		X
Improve external collaboration			X	X			
Gain competitive advantage							X
Processes consolidation	X	X	X		X	X	X
Legislation compliance	X	X		X	X	X	X
Integration of systems	X	X	X	X	X	X	
Adapt new functionality	X	X		X	X	X	X
Management of modification	X	X		X	X	X	X
Automation		X			X	X	
Improve ways of operating	X		X	X		X	
Attain better scalability			X		X	X	X
Restructure business processes		X	X		X		X
Increase performance	X		X			X	X

2.1 ES upgrade drivers classification

ES upgrade can be considered as an innovation due to the following reasons: First, ES upgrade introduces changes to the existing business processes and implementation of new functionalities (Khoo and Robey, 2007). Second, upgrading expands core system capabilities by taking advantage of new technology features (Vaucouleur, 2009). Third, upgrading ensures that the system is stable, operates efficiently, and can be expanded according to the organisation's needs (Hecht *et al.*, 2011). In comparison to the information systems (IS) innovation taxonomy by Swanson (1994), it can be reasoned that upgrading enhances the efficiency of IS tasks, improves administrative functions, and enriches the features embedded in the core systems. As a result it improves productivity and systems performance, minimises maintenance efforts, and increases competitiveness. Tornatzky and Fleischer (1990) propose that the decision to adopt an innovation is influenced by external and internal factors, including the characteristics of the technology. Likewise, ES upgrade decisions are influenced by various internal and external drivers.

Though T-O-E framework has been mainly used to study adoption of new technology innovations in organisations, Claybaugh (2010) adopts this framework to study ERP upgrades and suggests that it will allow to understand factors affecting, upgrade decisions, as organisations are at different assimilation stages, which is also suggested by Claybaugh *et al.* (2015). Oliveira and Martins (2011) suggest that the T-O-E framework has an established theoretical base and consistent empirical support for studying adoption of an innovation. Based on this context, the T-O-E framework is adopted as an investigative lens for analysing ES upgrade drivers. As a result, these drivers were classified into three contexts: technology, organisation, and environment. The technology context represents existing and new technologies relevant to the organisation, including their benefits, compatibility, and complexity (Lian *et al.*, 2014). Organisational context describes the internal measures such as scope, size, managerial support, and availability of resources. Environmental context refers to the field in which the organisation operates; this includes elements such as government legislation and vendors' support. The categorisation of the drivers differs from that of the T-O-E framework; however, according to Tornatzky and Fleischer (1990), specific categorisations may vary across different studies, as the characteristics are subjective.

2.1.1 Internal (technology) factors. These drivers describe both the internal and external technologies advancements and their benefits to the organisation; however, what one organisation perceives as a benefit is not always reciprocated in another organisation (Claybaugh, 2010). Markus and Tanis (2000) suggest that it is possible for two organisations to achieve the same benefit but gain different value from the benefit. The benefits for upgrading are achieved by comparing the new version against the existing version to gauge the usefulness and contribution of both versions (Ng, 2011). The value of the new version materialises from its offering of new functionality and improved business process and technologies (Dempsey *et al.*, 2013). Thus, organisations are more likely to upgrade when the benefits are known, that is, the relative advantage of upgrading. Another category identified is compatibility, signifying the degree in which the new technology can be adopted without causing disruptions to the existing systems and its supporting infrastructure. Given that new technologies are made available with latest versions, it is possible for disruptions to occur. According to Whang *et al.* (2003, p. 1035), it is common for the new version to introduce changes that affect the operating system and database system "due to the higher version requirements". This implies that it is important to consider hardware and supporting systems stability to accommodate the changes proposed by the new version. Another issue to consider when upgrading is the compatibility of the changes on the existing version's functionality or prior modifications implemented to the system and on inter-organisation systems. For example, in order to remain competitive, an organisation integrates their ES with their supplier systems (Vaidyanathan and Sabbaghi, 2007), which triggers the need to ensure stability and reliability of the systems when upgrading in order for the systems to operate smoothly. Overcoming compatibility is regarded as one of the reasons organisations opt to upgrade their systems, particularly when there are inter-organisational systems. Beatty and Williams (2006) posit that this is one of the main challenges during upgrade and consumes most of the project time and effort.

2.1.2 Internal (organisation) factors. One of the essential organisational factors is access to important information, which supports making decisions and improves productivity (Beheshti and Beheshti, 2010). Important information in this context represents accurate, timely, and relevant information that facilitates making decisions with ease. Another is to leverage ES in order to gain a competitive advantage by improving productivity and increasing financial performance through aligning business strategies with functionality (Ng *et al.*, 2003; Nicolaou and Bhattacharya, 2006). Alignment of the system can be achieved through expanding the existing systems' capabilities through either modifying the system or implementing new features. According to Otieno (2010), the aligning of the system's functionality to organisation strategies could be accomplished by upgrading to a newer version. Normally, this results in business transformations, which ensure that the organisation adapts to the changing economic and market conditions. Worrell (2008) suggest that in order to support the transformations, the organisation requires eliminating redundant processes and re-engineering some of the processes or the implementation of new business processes. Thus, considering and planning for alignment may result in the organisation upgrading their system to take advantage of the new version features, in order to achieve existing and future goals that define the strategic direction of the organisation.

Beatty and Williams (2006) and Olson and Zhao (2007) stress the importance of management in influencing upgraded project's success. Thus, we consider that management support plays an important role in upgrade decisions. Another aspect is upgrade costs, which significantly influence upgrade decisions. According to Swanton (2004), upgrade costs are almost "50% of the original software licensing fee and 20% of the original implementation cost per user – £5.2 m for a 5,000-user system". Likewise, Otieno (2010) suggests that upgrading costs ranges between 20 and 30 per cent, while Ng *et al.* (2003) estimate it ranges between 25 and 33 per cent of the initial implementation cost. Hence, over the years, upgrade costs remain a consistent factor that has always been considering as an ES upgrade inhibitor.

2.1.3 External (environment) factors. These external factors define conditions that give the organisation little choice but to upgrade their systems. Mostly these factors would be initiated by different external stakeholders such as vendors, partners, consultants, and legal entities. For example, the frequent versions release cycles introduced by vendors creates a dilemma of when it is appropriate to upgrade. On one hand, vendors provide organisations with the flexibility of not upgrading frequently, as they support multiple versions (Khoo and Robey, 2007). Hence, vendors have an important role in influencing upgrades through offering technological improvements and new features with each version release. On the other hand, vendors use high license fees and support pricing schemes for older versions as a technique to encourage organisations to upgrade their systems (Sawyer, 2000). Other external factors can be regarded as compliance with legislative changes and regulations since organisation opt to upgrade in order to fulfil government regulations such as changes in taxation. Additionally, organisations that operate in highly regulated environments such as education institutes and banking have to follow directives and regulations set by centrally governed agencies or governmental bodies (Khoo and Robey, 2007; Ng and Wang, 2014). In the context of environmental factors, the literature portrays a mixed reaction on the significance of these factors in influencing upgrade decisions. For example, Otieno (2010) suggests that business needs, which include the requirement for new functionality and automating processes, have higher priority when compared to environmental factors. Claybaugh *et al.* (2015) demonstrated that there is a mutual degree of influence from organisational and environmental factors on upgrade decisions. Thus, it is important to establish the extent of environmental factors on upgrade decisions.

2.2 ES upgrades strategies

According to Dempsey *et al.* (2013) and Feldman *et al.* (2015), organisations can undertake either a technical or functional upgrade or a combination of both as their upgrade strategy. Technical upgrade necessitates moving the existing system to a new version of the latest technology platform, so as to leverage latest technology features and to align the systems within the product life cycle. This implies that a technical upgrade is independent of a functional upgrade and concentrates mostly on changes to the technology aspects of the system such as the system architecture (Dempsey *et al.*, 2013). Undertaking a technical upgrade involves analysing the structure of data dictionary objects and evaluating the individual coding areas to confirm that the changes do not disturb the existing system (Beatty and Williams, 2006). However, functional upgrade mainly concentrates on functionality extension and optimising business processes based on the organisation's business needs. This may also involve consolidation of different systems to provide better agility and flexibility to support the integrated systems. Hence, during functional upgrades, the generic functionality offered in the new version will be implemented with the aim of optimising business processes, which may result in re-applying the modifications and re-engineering existing business process (Riedel, 2009). However, there are instances where both technical and functional upgrade are required. For example, a technical upgrade will be undertaken first to ensure the underlying system's platform is up to date and is capable of accommodating the changes to be introduced by the functional upgrade. Although some studies (Khoo and Robey, 2007; Zhao, 2007; Dempsey *et al.*, 2013) make reference to upgrade strategies, there is limited explanation on how organisations decide to undertake a particular strategy. Each upgrade strategy attempts to achieve a particular outcome; hence, it possible that the upgrade drivers play a role in influencing the selection. This association between upgrade drivers and upgrade strategy is theorised in Figure 1. In addition, based on the drivers identified from the literature and the analytical lens, Figure 1 is used to provide guidance for data analysis, which compares the theoretical constructs from this study to those of previous studies in order to draw conclusions from this study.

3. Methodology

The use of surveys has been widely accepted in IS research (Pinsonneault and Kraemer, 1993; Oates, 2006); however, it is normally associated with quantitative research (Creswell, 2009). Contrary to this belief, Fink (2003) and Jansen (2010) argue that survey is a viable approach when conducting qualitative research and explain that the purpose is to study the diversity and depth within the research questions. Thus, from a methodological perspective, qualitative survey allows the cross-examination of multiple respondents. Hence, this research follows a qualitative survey design. There are several reasons for adopting qualitative survey. First, to address the research questions, there was a need to attain realistic information from respondents who were involved in ES upgrade projects. According to Oates (2006), using a survey approach allows the researcher to engage and collect the same kind of data from a cross-sectional sample of the respondents. In turn, the researcher gathered upgrade experiences from multiple respondents to establish common and diverse views on the factors influencing upgrade decisions. Second, there was a necessity to associate information obtained from previous studies, in order to establish if the upgrade drivers are applicable across different systems. Hence, the use of qualitative survey facilitated exploring ES upgrades dimensions in order to offer insights into complex issues based on gathering realistic information from respondents. Such rich descriptive insights that explain the factors influencing ES upgrades are subjective to the people involved in the process; hence, it requires an approach that can derive meaning and relationships to gather a detailed understanding (Denzin and Lincoln, 2011). Figure 2 outlines the different data collection techniques and the data analysis approach adopted in this study.

3.1 Data collection

Overall, two data collection techniques were utilised in this study to complement the deficiencies and biases that may arise when using a single method (Creswell, 2009). First, web-based questionnaires were used to establish respondents' attitudes and experiences along with identifying the upgrade processes practiced in their organisations along with the drivers influencing the decisions to upgrade. According to Kaplan and Maxwell (2005), questionnaires (including web-based) could be used as one of the main data collection sources in a qualitative survey; however, the survey instrument should include open-ended questions. In this study, the survey instrument included both open-ended and close-ended questions. The closed-ended questions

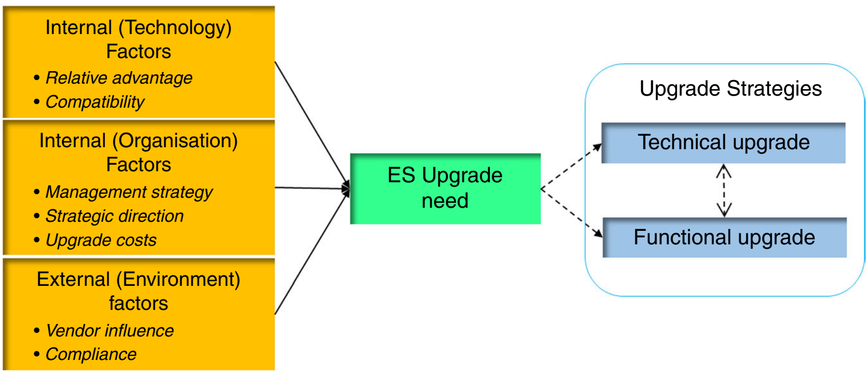

Figure 1.
Research model: the potential association between upgrade drivers and upgrade strategies

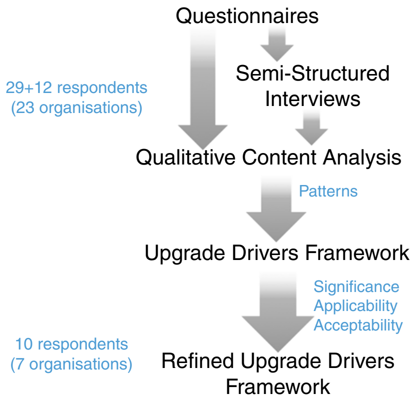

Figure 2.
The qualitative survey research design

asked the respondents to indicate their level of agreement or disagreement based on a five-point Likert scale and binary-answer options. Mostly these kind of questions were used to capture if the factors identified in the literature (Table I) were applicable to the entire ES upgrade landscape. The open-ended questions allowed probing for more details about the upgrade drivers by encouraging the participants to provide in-depth descriptive accounts of their experiences on ES upgrade within their organisations.

Second, semi-structured interviews were used as another data collection technique. Semi-structured interviews offer a flexible approach to explore complex issues and gain rich detailed insights based on people experiences and knowledge of the ES upgrade processes. Also, semi-structured interviews allow engaging with respondents who are regularly involved in the process under study (Silverman, 2005). Hence, gathering the accounts of people who are involved in upgrade projects could provide in-depth information, which cannot be captured using questionnaire. In addition, it can assist to overcome some of the criticisms of using web-based questionnaire, such as issues with anonymity and repeat responders when using web-based questionnaire.

3.2 Respondent selection

Snowballing and purposeful sampling were used to recruit respondents for the study. First, purposeful sampling was used to request access to SAP and Oracle UK user group members. Both user groups represented organisations from UK and Ireland, which use systems from SAP, Oracle, JD Edwards, PeopleSoft, or Primavera. The administrators from both user groups offered to circulate our request in their monthly newsletters. Second, a snowballing technique was used to search for the respondents who may not be part of these groups, as they could offer a different upgrading experience. The approach involved manual searching of LinkedIn® professional networking services for respondents based on the description provided in their profiles and location (UK and Ireland). Then an e-mail was sent out inviting them to participate in the study and politely requesting them to forward the message to their contacts with similar experience. For the interviews, the respondents were selected based on the suggestion from Olson and Zhao (2007), who explained that upgrade is a continuous process recurring at least once every three years; hence, the respondents level of experience was set at six or more years as these respondents would have been involved in more than one upgrade project.

3.3 Data analysis

Qualitative content analysis principles guided the overall data analysis of this study, which implies that the web-based questionnaire and semi-structured interviews were qualitatively analysed. This allowed to compare and aggregate the data from different respondents representing their respective organisations. As a result, different observations and trends could be categorised in respect to the drivers, upgrade process, and decisions organisation undertake when considering upgrades. Thus, for this study, the unit of analysis was organisations, as the main aim of the study was to explore the factors influencing the organisation to upgrade their ES. The data were collected from respondents whose organisations either recently upgraded or are in the process of upgrading or planning to upgrade in the next few months. According to Beatty and Williams (2006), the upgrade projects encompasses different stakeholders, representing the functional and technical aspects of the system and management, who are mostly driven by different motives. Thus, it was opted during the web-based questionnaire to target at least two respondents from the same organisation to cover both the technical or functional perspectives.

The data from both data collection techniques allowed gathering detail descriptions of factors influencing organisations to upgrade their systems, along with the upgrade process. As part of the analysis, the following three steps were followed: preparing the data, systematic coding, and drawing conclusions. Preparing the data involved studying the data as a whole to get a broader picture of how it reflected the research question. This involved summarising the concepts to understand the commonality between the data. Systematic coding used descriptive and interpretative pattern codes based on Miles and Huberman (1994) code classification. This involved summarising and grouping the data into segments, which was then systematically labelled to give meaning to the segments to eliminate repetition. Next, any significant relationships emerging from the segments were acknowledged, in order to formulate a high-level analytical content with the intention of deriving the theoretical attributes. The systematic coding for the interviews and open-ended questions was done by two other independent coders, in order to ensure reliability of the codes, segments, and patterns. Drawing conclusions involved exploring the identified segments to provide an explanation based on the theoretical propositions identified about the research question and comparison to the contexts represented in Figure 1. This involved frequent visits to the notes and transcriptions in order to justify certain arguments vs the patterns.

Additionally, this study uses respondent validation as a strategy to increase confidence and rigor in the findings. Respondent validation was applied in twofold: first, the summary of interviews was sent to the interviewees to validate its contents for accuracy and if necessary amendments were made to the interview summaries. Once the review was verified, some of the details were posed as additional questions to the other interviewees, to get their opinions on the earlier descriptions of upgrade decision making. Then a comparison between the answers was made to analyse the similarity of the different experiences. Second, the findings were evaluated by presenting to a different group of respondents with similar upgrade experience and knowledge to assess the accuracy of the findings and its applicability and significance in influencing ES upgrades decision.

4. Findings and discussion

The web-based questionnaire survey was conducted from May to September 2013; its responses were analysed prior to the semi-structured interviews. Although the web-based questionnaire offered detailed insights and a high-level view of the upgrade processes, there were limitations in terms of the depth of the explanation provided.

For example, six respondents suggested their organisations were undertaking a technical upgrade only, and another five suggested their organisation undertook functional upgrade only. The insights obtained from the analysis of the web-based questionnaires indicated that most of the drivers obtained from previous studies focusing on ERP or another sub-set of ES were applicable in influencing the upgrade of the whole ES landscape. Additionally, the data facilitated refining the initial thought process on the potential association between these drivers and upgrade strategies. However, most of the responses required an in-depth explanation for each instance a different upgrade strategy was selected, because of several drivers, but in each case, no explanation was provided. Thus, it was difficult to draw any significant conclusion on the association between the upgrade drivers and upgrade strategy selection, even though the data indicated some level of association. Therefore, in order to attain a detailed explanation, some of the patterns from the questionnaire analysis were used to inform the design of the semi-structured interview, which was conducted from December 2013 to March 2014; this allowed to obtain an in-depth understanding along with establishing any associations between the upgrade drivers and upgrade strategy.

In total, 41 respondents participated in both data collection techniques. Of the 41 respondents, 29 completed the web-based questionnaires representing 18 different organisations. At this stage, most of the organisations were represented by two respondents. In addition, 12 respondents participated in the semi-structured interviews representing 11 organisations. However, six respondents had also participated in the web-based questionnaire; thus, only six new respondents participated in the interviews, representing an additional five organisations. In the interviews, all but one organisation were represented by a single respondent. The reason for having two respondents from an organisation was because the initial respondent believed that speaking to another member of the team that is involved in daily management of the systems could provide a more detailed explanation of the upgrade drivers and process. After interviewing 12 respondents, it was observed that a detailed subjective understanding and a relevant level of diversity of the phenomena under investigation was obtained, and no new dimension was being added, which according to Jansen (2010) could be argued that the study was reaching its saturation point. In conclusion, the total number of organisations involved in this study were 23 large organisation. Based on the explanation by Laukkanen *et al.* (2007), organisations with 250+ employees can be considered as large enterprises; hence, the respondents of this study are considered to be from large organisations.

Most of the organisations were based in the UK and Ireland, but a few have international footprints; for example, two of the organisations were subsidiaries with their headquarters in Asia, while other three had offices across Europe. For those organisations based in UK and Ireland, the upgrade team was either located locally or from abroad. All respondents were at minimum involved in one upgrade project and were actively involved with the decision-making process. The respondents represented diversified roles and the majority of them have more than four years of experience in managing ES (Tables II and III). Some of the respondents (e.g. the chief financial controller) were not directly involved with the day-to-day management of ES; however, they were part of the upgrade team representing the top management.

The pool of respondents consulted in this study offer a distinct selection of expertise and knowledge, which supports in-depth views on the upgrade process, an essential criterion to provide the necessary depth and richness required to address the research question. The study findings were presented and discussed with ten respondents from

Role	Count
Solution architect	7
Project manager	10
Systems analyst	4
Functional lead	9
Technical lead	7
Database administrator	4
Systems administrator	2
Chief financial controller	1
Database administrator	1
Information systems manager	1

Table II. Respondents' roles

Experience	Count
< 1 year	0
1-2 years	1
2-4 years	5
4-6 years	4
6-8 years	14
> 8 years	17

Table III. Respondents' experience

seven different organisations, with the aim of gathering their opinions as an alternative mechanism to evaluate the interpretation of the findings. These respondents were involved in more than two ES upgrade projects and were actively involved in the decision-making process. In addition, as a mechanism to gauge the relevance of the drivers identified in respect of influencing the entire ES landscape upgrade decisions, the respondents were explicitly asked to suggest if such drivers were applicable to all of the systems within the ES landscape.

4.1 The upgrade drivers

Organisations need to continuously plan and account for upgrade projects; however, the decision to upgrade is dependent on balancing the interaction of numerous technological, organisational, and environmental drivers, irrespective of the systems or vendors providing these systems. At least 25 of our respondents suggested that their organisation adopted a persuasive upgrade philosophy. According to Seibel *et al.* (2006), this is an undocumented management philosophy but regarded as a common strategy among management circles. This implies that the manner in which management strategies on upgrade influences the decision to upgrade; as they would not opt to upgrade immediately when a new version is released unless a justifiable need is established and (or) when upgrades can be associated with tangible and intangible benefits. While some of the categories bear similarity to those proposed by Claybaugh (2010), the findings presented in this paper extend those of previous studies by providing additional categories that highlight the role of consultants, the different strategies adapted by the management, and how compatibility issues influences upgrade decisions. In addition, the findings suggest that upgrade drivers identified in previous studies are applicable when considering upgrading different systems within the ES landscape despite being from different vendors. In this paper, we classify the drivers influencing the decision to upgrade into three main contexts and several categories, as summarised in Table IV.

4.1.1 Technological context. There are several advantages gained by upgrading, such as new features, and most of the respondents explained that their organisation opted to upgrade their systems as a mechanism to take advantage of the additional capabilities and features introduced by the new version. In addition, two respondents suggested that they upgraded their systems and infrastructure as a result of new security features, while other respondents explained that their organisations applied patches to their systems as a countermeasure to security concerns. Yet, it is acknowledged that security issues can lead to upgrades especially to the technology and infrastructure that supports the systems; which in turn could lead to upgrading the functional aspect of the system. In addition, this study's findings suggested that through upgrading, the majority of the support personnel time and efforts were directed towards other critical process refinement and automation, thus allowing for transparency and accountability. The adoption of new functionality, may provide flexibility; however, it may not be compatible with the existing version, hence making the system landscape unstable and increasing the chances of disruption. For example, two respondents suggested that there is a significant difference in the system objects offered in the new version, which can cause disruptions particularly when not compatible with existing modifications. According to Beatty and Williams (2006), such situation requires rigorous testing to guarantee that systems would be stable and reliable after the upgrade. Not surprisingly, all organisations in this study considered

Context	Categorises	Drivers
Technological	Relative advantage	Improve usability and security New functionality
	Compatibility issues	Stability Reliability
Organisational	Management strategy	Management philosophy Continuous improvement Automate existing business processes
	Strategic direction	Merge systems across the organisation Restructure business processes Consolidate business processes Consistent system architecture Standardise functionality Integration of different systems Reduce maintenance costs
	Upgrade costs	Licensing fees Infrastructure costs Testing and reapplication of modifications
Environmental	Vendor dependency	Attain continuous vendor support Leverage the latest technology
	Compliance	Comply with legislative guidelines Implement national standards Acceptable structure and mode of operating
	Consultants' influence	Knowledge and experience Trust and relationships

Table IV.
Upgrade drivers framework

testing as one of the main activities during upgrades, and several different testing strategies are used to ensure systems operate as planned. This involves identifying and proposing mechanisms to address all the changes in the code and systems objects to align these with the existing modifications. Depending on the level of effort required to address these issues, the organisation will assess if it is feasible to move ahead with the upgrade or select an upgrade strategy that is feasible to achieve.

4.1.2 Organisational context. These drivers are relative and perceived differently from one organisation to another. For example, high initial upgrade costs resulting from licensing fees, infrastructure, testing, and reapplication of modifications can lead to postponing the upgrade. On the contrary, reduction of overall operational, management, and maintenance costs can influence the organisation to upgrade. For example, five respondents claimed their organisations achieved operating cost reductions by aligning the systems to a consistent architecture and replacing modifications with standard system functionality when upgrading. However, there was no evidence presented to substantiate if any cost reduction occurred after upgrading. Thus, depending on the stakeholder's perception of the upgrade benefits, costs can either influence or hinder the decision to upgrade, which indicates an alternative perspective from previous studies (such as Khoo and Robey, 2007; Otieno, 2010; Dempsey *et al.*, 2013) who advocate that costs act as an inhibitor to upgrade decisions.

In addition, similar to previous studies mentioned above, top management involvement is important to ensure the success of an upgrade project. Even though top management involvement is minimal, when the case for upgrade was proposed by the top management and received support, it would ensure the project is assigned realistic timelines and resources. In six of the organisations where top management supported the project, both technical and functional upgrades were undertaken; though this not a definite indication that top management support will result in both upgrade strategies, as other drivers have to be taken into consideration. Yet, it can be reasoned that when top management is involved, there is minimum project scope trade-offs when compared to cases in which there was limited management support. Furthermore, similar to an explanation from Davenport *et al.* (2004), mergers and acquisitions are an on-going process in organisations as part of their strategic direction. These mergers resulted in frequent changes to the business structures and processes, which dictate the need to integrate and have consistent systems to support their business vision, objectives, and processes. This was a case with one of the organisations in this study that had to upgrade to be on a consistent system version, in order to be able to integrate and standardise their processes with the other company. Additionally, some organisations claimed that they opted to upgrade, in order to improve performance and become more competitive.

4.1.3 Environmental context. The findings from Claybaugh (2010) is supported as there is a need to equally concentrate on the external drivers, which differs from the argument raised by Otieno (2010) that business needs (i.e. organisational drivers) have higher priority. The possible explanation for this difference is organisations that rely on vendors for continuous support and maintenance would tend to upgrade their systems whenever a new version is available in order to gain continuous support. Similar to previous studies, the study's findings suggest vendors influence the decision to upgrade, for example, by withdrawing support for older versions, and organisations are given no choice but to upgrade their systems in order to maintain continuous support. As a result, five organisations upgraded even when the new version did not offer any improvements or benefits to the organisation; this was mostly applicable to organisations that were depending on vendors for support. In addition, vendors tend to lock-in their customers, with limited support and high licencing and maintenance costs for older versions; for example, five organisation in our study opted not to upgrade their systems, as a result they did not receive support in a timely fashion and had to pay high premiums to get support for their older versions. In regards to compliance, similar observations to Khoo and Robey (2007) were drawn that is organisations in controlled environments upgrade their systems in order to keep up with the regulations and policies. However, due to the frequency (at least once a year), these changes can be accomplished by simply patching certain rule sets and attributes in the systems. This is in contrast to the suggestions proposed by Kremers and van Dissel (2000) who mention compliance as a technical upgrade, while in this case, it is mostly regarded a routine upgrade to the functional aspects of the system.

Consultants' influence was a recurring theme, as most of the respondents suggested that their organisations call upon consultants during upgrade discussions to gain relevant and timely information, relating to the new version. The perception is that consultants can provide detailed functionality descriptions in a manner that organisations can comprehend easily when compared to vendor documentation, press releases, and websites. Although consultants play a critical role in influencing upgrade decisions, the level of influence depends on how much confidence the organisations place on the consultants' knowledge and experience. In order to minimise potential pitfalls, risks, and disruptions associated with upgrades, same consultants are used for many different projects, which results in trust and good working relationships. However, organisations normally exercise caution, when using consultants, in order not lose control of critical upgrade decisions.

4.2 Upgrade strategy selection

Based on the data gathered, we hypothetically suggest that it is possible the upgrade drivers influence the upgrade strategy selection, i.e., undertake either a technical or functional upgrade or both as shown in Figure 3. Given that this is a qualitative study, it is acknowledged that it is difficult to conclude with certainty that there is an association between upgrade drivers and upgrade strategies. However, the trend in the data indicated that some organisation upgraded because of certain specific drivers, for example, organisations that only wanted to be within the vendor release cycle in order to attain continuous support would normally consider undertaking technical upgrade only.

Nevertheless, it is very rare for a single driver to influence an upgrade strategy, thus an upgrade strategy will be selected as a result of the collaboration between the different drivers. However, when one or two drivers result in the selection of either a technical or functional upgrade, this can be regarded as a direct influence indicated by the blue and red solid lines in Figure 3. While the dotted lines highlight that the interaction of different drivers can result in undertaking either one or both upgrade strategies, the green colour indicates that technical upgrade would be the selected upgrade strategy, but it may result in functional upgrade. The yellow colour suggests that functional upgrade would be the ideal upgrade strategy, but it may also require a technical upgrade to be undertaken. For example, if the upgrade goal is to take advantage of the latest functionality to support the business users' requirements, then only a functional upgrade may be commissioned. However, if the underlying system's

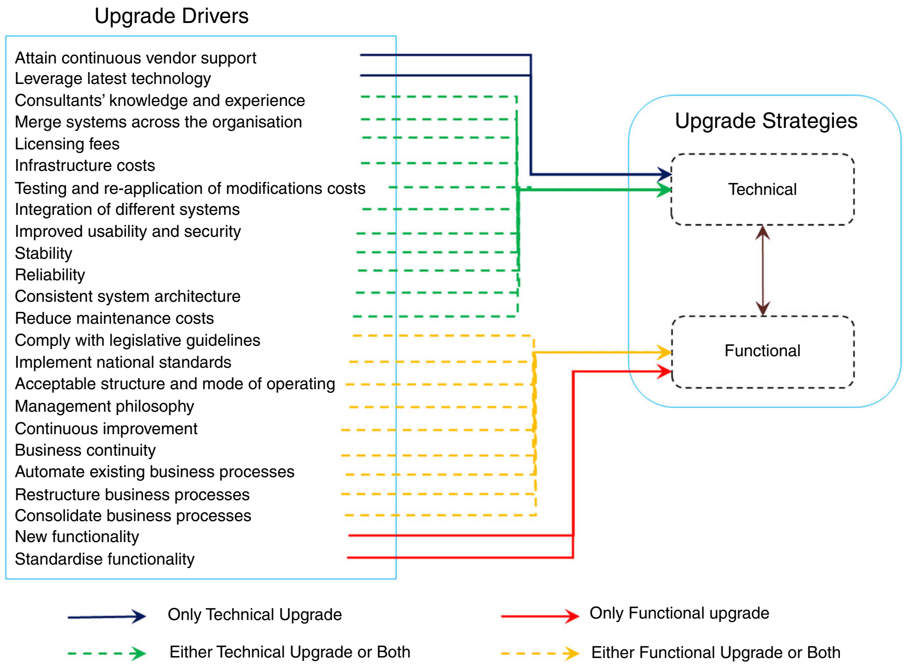

Figure 3. A conceptual association between upgrade drivers and upgrade strategy

technical platform cannot support these changes, it creates a necessity for undertaking both technical upgrade and functional upgrade, in order to ensure the system can support the proposed functionality changes. This behaviour is considered an indirect influence. This potential, the relationship between the drivers and upgrade strategy selection, can offer an explanation of why organisations prefer to undertake a certain upgrade strategy. However, in this study, we are only proposing logical generalisation, and we recommend future research to explore these conceptual relationship proposed in this study and provide probabilistic generalisation, which could offer either similar or conflicting arguments applicable to ES upgrade strategy selection.

5. Conclusions

This paper has given an account and categorised the reasons for upgrading ES. From a theoretical position, this research supplements and extends previous studies on ES upgrades by demonstrating the applicability of earlier factors influencing upgrade decisions. From an organisational perspective, this study provides a detailed account of upgrade experiences from 23 organisations, providing insights and a broad understanding of the interplay between the different drivers and their role in selecting an upgrade strategy. In addition, this research suggests there is a relationship between the upgrade strategy and upgrade drivers, which offers a logical strategy that can be followed when contemplating upgrade decisions to decide which upgrade strategy to select. As such, organisations could learn from the experiences of these 23 organisations, and devise an upgrade approach that minimises disruptions and risks, and allocates resources appropriately, along with reducing the complexity associated with upgrade projects.

Despite the small group of respondents involved in this study, the two data collection approaches allowed discovery of several upgrade drivers contributing to the growing body of literature on ES upgrade. However, as the majority of the respondents represent large organisations, the findings could be considered context sensitive; hence, only logical generalisations can be drawn. Therefore, further efforts to expand and extend the findings are required. Additionally, future studies could explore the full upgrade cycle in order to provide a detailed understanding of the dynamic nature of ES upgrade and identify strategies and mechanisms that can help to establish a balance between the needs of the stakeholders.

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