Risk management in enterprise resource planning implementation: a new risk assessment framework

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1.Introduction

Enterprise resource planning (ERP) is designed to provide seamless integration of processes across functional areas with improved workflow, standardisation of business practice, and access to real-time, up-to-date data. As a consequence, ERP systems are complex and implementing them can be a challenging, complex, time consuming and expensive project for any company (Yusuf et al. 2004, Koh and Simpson 2007). Although there are multitude of installed ERP systems, ERP projects continue to be considered risky to implement in business enterprises as they fail for a variety of closely interconnected organisational and technical factors (Hallikainen et al. 2009). In fact, the introduction of any large-scale integrated information system (i.e. ERP) can lead to significant changes in processes, tasks and people-related issues (Kraemmerand et al. 2003, Winter et al. 2006). The particular risks associated with ERP projects make it necessary for organisations to deploy risk management approaches throughout the project life-cycle (Aloini et al. 2007). The need for risk management approaches arises due to the lack of effective guidance on the implementation of ERP (Ngai et al. 2008). The reluctance of companies to communicate about implementation failures (Hakim and Hakim 2010) does not make it easy for researchers to propose and test efficient frameworks. So far, the literature on ERP projects (Kutsch and Hall 2005, Bakker et al. 2009) reveals that (1) knowledge of the risks alone is not sufficient for companies deploying a risk management approach and (2) the deployment of systematic and scientific approaches by managers is uncommon.

Based on publications from 1997 to 2009, Baker et al. (2009) also state that the current studies are largely based on how risk management is assumed to work instead of how it is actually used in project practice. The main purpose of this article is to develop a new risk assessment framework (RAF), which enables better management of those risks. The study distinguishes itself from the existing literature on ERP risk management by adopting a more balanced and integrative framework as it demonstrates a practical and holistic approach to identifying and managing risk in ERP implementation. It integrates risk identification, analysis and control by classifying risk hierarchically (external engagement, programme, work stream and work package levels) across technical, schedule, operational, business and organisational categories. This not only helps develop responses to mitigate risks but also facilitates risk control through the organisational hierarchy.

This article first reviews the literature in order to identify various risk factors and challenges of ERP implementation, along with any available risk management frameworks. Then using a case study it demonstrates the application of the new RAF for managing ERP implementation.

2. Literature review
Whilst there are studies on various aspects of ERP implementation in industry, we still know little on how to practically manage risks and uncertainties of ERP projects as the majority of companies still fail to effectively implement ERP systems.

2.1. ERP implementation risks
Davenport was amongst the first to report the challenges of ERP implementation and business process change (Davenport 1998). Several studies state that amongst the main reasons for IT projects failure is the misperception of project risks and the inadequateness of risk management by project managers (Kwak and Stoddard 2004, Aloini et al. 2007). In recent years, several researchers have tried to identify the critical success factors for ERP implementation (Al-Mashari et al. 2003, Mabert et al. 2003, Mandal and Gunasekaran 2003, Umble et al. 2003, Woo 2007). Motwani et al. (2002) investigate factors that facilitate or inhibit the success of ERP projects based on a case study methodology comparing a successful ERP implementation with an unsuccessful one. They unveil several ERP

implementation risks amongst which are the following: ineffective strategic planning and communication and insufficient project team skills. The authors conclude that careful change management, network relationships and cultural readiness are key success factors.

Yusuf et al. (2004) focus on the issues behind the process of ERP implementation by means of case study methodology. This article examines business and technical as well as cultural issues of ERP implementation in Rolls-Royce plc. It highlights the need for adequate communication approaches and business process reengineering (BPR), and for improved project and change management techniques. The authors highlight the necessity for matching the processes to specific software configurations, training senior management and end-users, and educating people to accept change.

Ehie and Madsen (2005) conducted empirical research on the critical issues which impact on the success of ERP implementation. They highlight several ERP risks such as inappropriate consulting services experiences, inadequate BPR, unsuitable ERP selection and low top management commitment. Aloini et al. (2007) produced the top 10 most frequent risk factors based on a literature review. The authors point out that top five risk factors are inadequate ERP selection, ineffective strategic thinking and planning, ineffective project management techniques, bad managerial conduct and inadequate change management.

A more recent study conducted by Malhotra and Temponi (2009) suggest six key factors which can lead to successful ERP implementation (1) project team structure, (2) implementation strategy, (3) database conversion strategy, (4) transition technique, (5) risk management strategy and (6) change management strategy. Another study devoted to ERP risk identification is conducted by Hakim and Hakim (2010). The authors categorise the risks involved in ERP implementation from the perspectives of the client-organisation and that of the experts. In doing so, they classify risks into six categories related to organisation, specialised skills, project management, system, user and technology.

ERP implementation risk could be categorised across the project phases with respect to project management processes, organisational transformation and information technology in order to suggest mitigating measures for each category (Table 1).

Table 1. Risk factors in accordance to project phase and risk category.

Project phases	Risk categories		
	Project management processes	Organisational transformation	Information technology
Planning	Inaccurate business case Unclear objectives Weak implementation team	Lack of management/executive commitments and leadership Lack of synergy between IT strategy and organisational competitive strategy Unclear change strategy	Lack of communication with the end users Inadequate training plan for the users
Implementation	Inappropriate management of scope Lack of communication between ERP implementation team, ERP provider and ERP users Poor contract management	Inappropriate change management Inappropriate management of culture and structure	Business process reengineering incompetence ERP installation incompetence Inappropriate selection of ERP software Inappropriate system integration Inaccurate performance data Inappropriate users training
Hand-over, evaluation and operations	Inappropriate contract closeout	Inadequate organisational readiness Resistance to change Lack of user training	Inappropriate system testing and commissioning Multi-site issues Lack of clarity on inspection and maintenance Inaccurate performance measurement and management framework

Successful implementation of ERP systems can result from effective management of these risks, which are very generic as they have been collated from a wide variety of ERP projects across industries.

2.2. Risk management frameworks

Like other project risk management, ERP implementation project risk management needs to be undertaken in three phases – the planning, implementation and post-implementation phases. Risk analysis in ERP planning phase is closely associated with ERP system selection, as prior research recognises that ERP implementation is a risky endeavour. Teltumbde (2000) adopts a combined nominal group technique and the analytic hierarchy process model to evaluate ERP systems and considers risk as one of the constructs. Lee and Kim (2000) applied the analytic network process and 0–1 goal programming approach for ERP system selection. Badri et al. (2001) use 0–1 goal programming with multiple criteria such as benefits, hardware, software and other costs, risk factors, preferences of decision

makers and users, and completion and training time commitments. The analytic hierarchy process-based approach with risk as one of the constructs has been adopted by Wei et al. (2005). Risk analysis in planning phase addresses part of the issues. There are considerable amounts of risk in any ERP implementation phase because of technical complexity and organisational transformation requirements.

Literature reports adoption of generic methods (e.g. PMI 2008, AS/NZS ISO 31000 2009) to manage ERP implementation risks (Aloini et al. 2007). Aloini et al. (2007) report a risk diagnosing methodology, which consists of context analysis, risk identification, risk analysis, risk evaluation, risk treatment, monitoring and review, and communication and consulting. They also suggest that risk management strategy consists of two approaches – the first aims at reducing risky circumstances, whilst the second deals with risk treatment after a risk appears. Markus et al. (2000) propose a multi-site ERP implementation framework to deal with the associate risk. They observe that multi-site ERP implementations are tricky on at least four different levels – business strategy, software configuration, technical platform and management execution. Successful multi-site ERP implementations address the interactions and trade-off amongst the four different sites; yet their approach is more conceptual than practical. Huang et al. (2004) suggest a more comprehensive approach using risk identification and analysis using Delphi techniques and the analytic hierarchy process, respectively. Although their model is theoretically sound, it lacks practical implication.

In summary, prior research has developed several methods for managing risk in ERP implementation that are both theoretically sound and practical for specific case. However, this study extends this work by providing a more holistic approach, that considers risks hierarchically (external engagement, programme, work stream and work package levels) for technical, scheduling, operational, business and organisational factors.

3. Methodology

The case study that follows reports an ERP project in the energy service sector in the UK. It illustrates the use of the new RAF for ERP implementation. In this case study, the project was successfully implemented with an appropriate risk identification and management strategy. Interviews with key actors were conducted using a structured interview guide (Appendix); the questions were developed from the literature review. The representatives of client, consultant and ERP vendor project group took part in the interview; all of them had more than 15 years experience in ERP implementation/industry operations. Data were also collected by means of direct observations and from internal documents.

4. Case study on risk management for ERP implementation

The following case study shows a customised project risk management framework that successfully helped the implementation of an ERP project in a UK-based energy service provider (hereafter referred to as 'The Group').

4.1. The Group

The Group was formed following the privatisation of the gas energy market in the UK and a subsequent de-merger of part of the business in 1997. It has since developed into an international business with a total turnover of GBP 13.4 bn. The Group employs over 30,000 people and has expanded globally through a strategy of acquisitions and partnerships in both Canada and the United States. More recently, the company has focused on entrance into the deregulating European markets.

As The Group had grown by acquisition and mergers, it now possesses an IT landscape consisting of disparate IT systems and disconnected processes. Accordingly, it has embarked on an ERP implementation and re-implementation strategy with SAP as the chosen ERP solution. The Group already had some sub-optimal ERP (SAP) implementations in parts of their business.

The Group adopted a phased approach focusing on the highest priority process areas first and gradually increasing the ERP modular footprint over a timescale of several years. The first two priorities on its roadmap lay in different process areas and had different strategic drivers and business case models. However, there were several areas of

commonality, such as a common ERP platform, a common implementation methodology and approach, and a common approach to the project management team structure and management processes.

4.2. ERP implementation project

This case study was a 10-month business transformation initiative consisting of a SAP ERP platform implementation for finance, procurement and HR processes with 1500 system users and 35,000 payroll records involved. To support its vision, The Group undertook this business transformation project to radically overhaul its back office systems and to reduce cost. The objectives were to achieve cross-functional simplification, automation, standardisation and integration. To have their three back office functions working in a fully integrated and largely automated way would provide an invaluable platform enabling the group to begin developing wider improvements, based on a common and flexible backbone.

The project involved implementing SAP's mySAP ERP application suite to support their HR and Finance, and the e-Procurement and Business Warehouse modules to support their operational activities. Overall, the new solution provided a platform from which the functions could transform their partnership and integrate to the rest of The Group's businesses far more effectively. The new solution was based on the SAP's Netweaver open platform, allowing legacy SAP and non-SAP applications to be fully integrated. A leading multi-national ERP consultant company was also engaged to plan and implement the project. They worked closely with the ERP provider and The Group's project management team from concept through to commissioning of the project in order to ensure effective implementation and operations. The Group's internal project team, external consultant project team and ERP vendor's project team formed a core mutli-skilled ERP implementation team. The Group's project team was formed through careful selection of experienced and capable people from both functional and IT focused areas.

The project resulted in the migration of significant volumes of complex legacy data (250 m transactions worth GBP 1.53 trillion); the solution was successfully implemented and achieved its objectives to provide simplified and standardised processes across the back office. The SAP ERP suite provided automated and integrated support for these processes.

4.3. ERP implementation risk management process

The core team managed risk in the project using the process shown in Figure 1; the process has the following high-level stages: identify and classify risk, analyse risk, determine approach to identified risk, track risk and mitigate risk.

Figure 1. Risk management process (high-level).
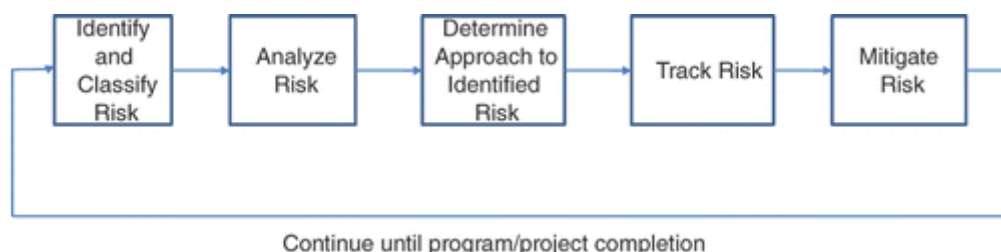
The risk management process involves a variety of stakeholders – each with different roles and levels of authority; each played a pivotal role in the identification analysis and control of risks.

The Programme Management Office (PMO) Risk Manager 'owns' this risk management process. The PMO generated risk update reports (RURs) – requiring fortnightly risk statistic updates from the Work Package Managers about the programme's performance which were accurately recorded, categorised and actioned. Action took the form of instruction to the Work Package Managers or escalation to a higher authority – the Release/Area Manager.

The Work Package Manager's role was to assess risks at the point-of-work, raise and update fortnightly RURs, and action instructions given by the PMO Risk Manager.

The Release/Area Manager received RURs fortnightly from the PMO Risk Manager, reviewed risks with Work Package Managers, solved work stream level risks and decided if some risks required escalation to a higher authority – the Programme Manager.

The Programme Manager provided instruction to Release/Area Managers on risk response strategies, managed programme management level risks, raised and updated risks fortnightly using the RURs, raised external risks with the Programme Board. The PMO RURs with critical programme level issues were reviewed in the programme management meetings (PMMs) when the client (The Group) and the vendor (SAP) were present.

The PMOs Risk Manager performed a critical integrative role dedicated to managing the ERP implementation risks. The PMO Risk Manager, Work Package Managers and Programme Manager were all external consultants. The RURs were conducted on a fortnightly cycle, as shown in Figure 2.

Figure 2. Risk control cycle.
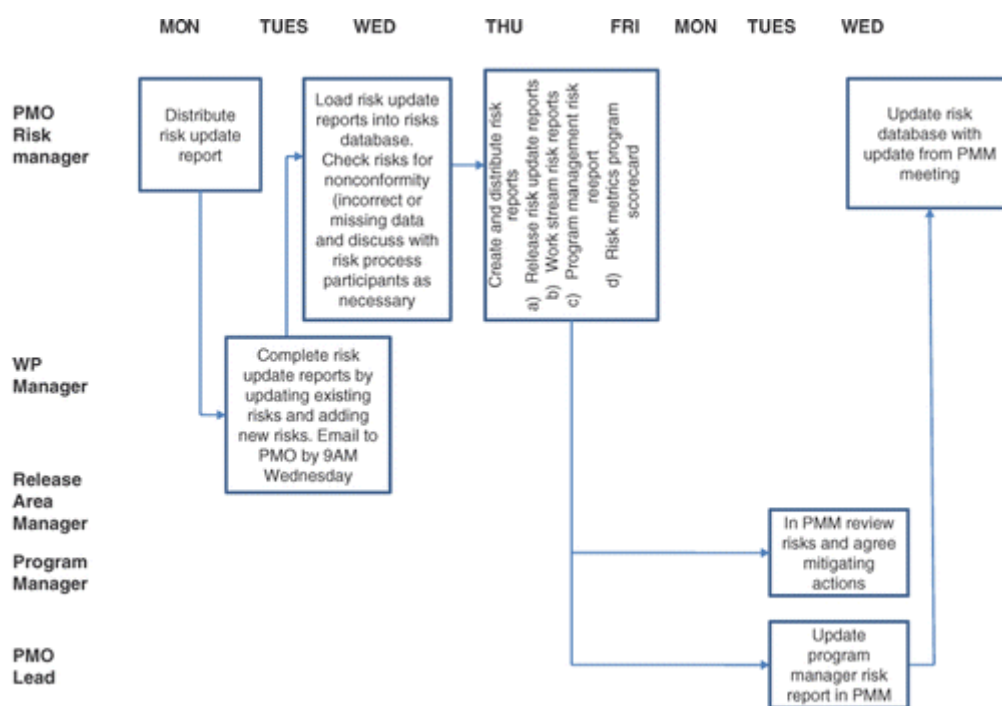
The risk control cycle began with the production of (RURs) which was distributed to each risk assessment participant. This allowed each individual to raise a new risk – completing each mandatory field in the document – or make updates to existing risks. The RURs were distributed on a Monday morning and returned to PMO with updates on Wednesday morning. The PMO risk manager liaised with each risk participant to ensure that the correct information was being reported before the consolidation of RURs into area specific RURs. This normally took place in the form of a phone call or a face-to-face meeting to verify. RURs were then consolidated which provides relevant risk information to the management team of each work stream, as well as the risk information relevant to other work streams, and the whole project.

However, even though a purposeful risk management process was in place, the core team did not, until this project took place, have a RAF to objectively differentiate the different types of risk in this process. As a result of this work, wider knowledge was brought to bear and an ERP risk analysis framework (RAF) was constructed and used; this became incorporated into the RURs. The following paragraphs further describe the stages in the risk management process and detail how the new RAF was used.

4.4. Risk identification
Risk owners were assigned and their responsibility was to determine the most appropriate treatment for the risk. Possible treatments include: acceptance, mitigation, transference and reduction. The risk management process was

repeated fortnightly and risks were debated in various forums at the appropriate escalation level. This process allowed work package, work stream and programme risks to be identified and mitigated.

ERP implementation risks were categorised into five key areas – technical, schedule, operational, business and organisational. Technical risks may arise due to selected technologies (hardware and software) developing performance, quality, reliability or security problems. Schedule risks may impact the ability to achieve the programme's goals within the proposed schedule. Operational risks evolve because of degrees of uncertainty in estimated implementation costs often due to 'scope-creep' (adding more and more features as the project progresses) which directly impacts on cost. Business risks may occur due to changes to economic or other conditions outside the direct control of the project, which can negatively affect the business case. These can include legal issues, government regulations, marketplace changes, user skills, political considerations, customer stability and funding. Organisational (internal) risks may prevent completion of the project or realisation of ROI. This may include the ability to provide both the physical facilities and appropriate personnel required to support the programme's work efforts.

Additionally, these risks were also given one of four levels – external engagement, programme management, work stream and work package level, in line with the incumbent reporting structure. External engagement level risks are those that involve client-based concerns and hence require customer actions to help mitigate. These are risks that the client should be made aware of in the interests of the programme as a whole, and have contractual implications. Programme management level risks have potential impact on several work streams, potential impact on significant release milestones, timing, completion or success as a whole; these are risks that cannot be fully identified or articulated by individual Work-Stream Level Managers. Work-stream level risks impact multiple work packages within the same work stream and require management and risk mitigation by a Work Package Manager. Work package level risks have an impact within a work package and could impact on the completion date, quality levels or costs of the work package; these risks can be managed and mitigated by the Work Package Manager, and do not require escalation to Programme Manager.

Risk factors, as identified in The Group were placed on the RAF as shown in Figure 2.

4.5. Risk analysis

Risk analysis involves analysing the potential impact and probability of identified risks in order to guide risk responses (Figure 3). This stage of the process occurred on an ad hoc basis within the teams, although the collection and formal logging of risks happened periodically (every fortnight). In order to evaluate risks more objectively, standardised scores were used to evaluate each risk, as shown in Figure 3; each risk factor is scored in the same way.

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Figure 3. Risk assessment scoring: impact and probability (R, A and G stand for red, amber and green, respectively).

HOW TO ASSESS RISKS:

Level	Impact	Description
1	**Cost** - < 50K GBP and/or **Schedule** – Risk of delay to activity/deliverable	Marginal Impact
2	**Cost** - 50K - 199K GBP and/or **Schedule** – Risk of delay to activity/deliverable	Moderate Impact
3	**Cost** - 200K - 499K GBP and/or **Schedule** – Risk of delay to activity/deliverable	Medium Impact
4	**Cost** - 500K - 999K GBP and/or **Schedule** – Risk of delay to Level 1 Plan milestone	High Impact
5	**Cost** >1M GBP and/or **Schedule** – Risk of missed Goal-live date	Critical Impact

Level	Likelihood	Description
1	<5%	Highly Improbable
2	5% - 25%	Unlikely Occurrence
3	26% - 60%	Possible Occurrence
4	61% - 85%	Probable Occurrence
5	>85%	Very Probable

Risk Factor= Impact x Probability

The Risk Factor allows Risks to split into three levels of **severity** – 'High', 'Medium', 'Low' (R, A, G)

Impact					
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5

Probability

Risks were prioritised according to their potential impact on the programme and likelihood of them occurring. Each was rated as a 'High' ('H'), 'Moderate' ('M') or 'Low' ('L') risk severity to The Group's overall ERP implementation programme. These are shown in Table 3 using 'H', 'M' and 'L', respectively, to represent each 'Impact' and 'Likelihood' [I, L].

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Table 2. Generic RAF for ERP implementation.

Categories	Levels			
	External engagement	Programme management	Work stream	Work package
Technical (hardware and software)	Legacy system change impact interfaces	Business resources required not available – business resource may 'overlap'	The project execution deviates from design/principles	Not meeting IT (hardware, software, network, security system) specification
	The project end-users fail to support deployment	Mismanagement of overall IT architecture	Quality at risk due to time/cost drivers	Data cleansing does not meet the requirements
			Insufficient servers' processing power	
		Fail to transfer knowledge (consultant to the business project resources)	Insufficient database capacity within SAP for the volume of transactions being migrated across from the legacy systems	
		SAP profiles do not correspond to organisation roles	Telecommunication links with outsourcing partners fails, resulting in a lack of access to SAP by the offshore team	
		Failure to move towards SOX[a] compliance	IT fails to resolve functional issues	
		Insufficient training facilities available	Delay in hardware procurement	
			Decision on system architecture configuration selection was not taken on time	
			Plan is not achievable because of many concurrent activities	
			Inappropriate system testing	
Schedule	Late decisions/sign-off	Organisation fails to adopt change		The new system fail to reconcile business information
	Legacy systems require changes which would be likely to delay the project			Scope creep
Operational	Communication risk between the project and the business	Failure to deliver benefits as outlined in the business case	No disaster recovery arrangements	
		Inadequate training	System malfunction in post-go-live phase	
		The new system fails to provide appropriate financial information		
		The information generated by the new system fails to comply with Data Protection Act		
Business	Risk that sponsor cancels the project	Lack of resources available from within the business to fill specific roles		
	The business suffers 'change fatigue'			
	Business inadequately prepared to take on new solution			
Organisational	Other projects that are happening in parallel within the business impact the ERP project	Project resources required not available e.g. for training	Project team 'burns out'	Lack of resources in new technology areas being implemented due to their specialist nature
				Project team turnover

Notes: [a]The Sarbanes–Oxley Act (SOX) not only affects the financial side of corporations, but also affects the IT departments whose job it is to store a corporation's electronic records. The SOX states that all business records, including electronic records and electronic messages, must be saved for 'not less than five years'. The consequences for non-compliance are fines, imprisonment or both. IT departments are increasingly faced with the challenge of creating and maintaining a corporate records archive in a cost-effective fashion that satisfies the requirements put forth by the legislation.

Table 3. RAF applied to The Group's ERP implementation.

Categories	External engagement	Programme management	Work stream	Work package
		Risk level *[Impact, Likelihood]		
Technical (hardware and software)	Legacy system change impact interfaces [**H, M**]	Business resources required not available – business resource may 'overlap' [**H, H**]	The project execution deviates from design/principles [**M, M**]	Not meeting IT (hardware, software, network, security system) specification [**H, L**]
	The project end-users fail to support deployment [**L, M**]	Mismanagement of overall IT architecture [**H, H**]	'Quality' at risk due to time/cost drivers [**M, H**]	Data cleansing does not meet the requirements [**M, H**]
			Insufficient servers' processing power [**H, L**]	
		Fail to transfer knowledge (consultant to the business project resources) [**H, M**]	Insufficient database capacity within SAP for the volume of transactions being migrated across from the legacy systems [**H, M**]	
		SAP profiles do not correspond to organisation roles [**H, L**]	Telecommunication links with outsourcing partners fails, resulting in a lack of access to SAP by the offshore team [**H, L**]	
		Failure to move towards SOX[a] compliance [**H, L**]	IT fails to resolve functional issues [**H, M**]	
		Insufficient training facilities available [**H, L**]	Delay in hardware procurement [**H, M**]	
			Decision on system architecture configuration selection was not taken on time [**M, L**]	
			Plan is not achievable because of many concurrent activities [**H, L**]	
			Inappropriate system testing [**L, L**]	
Schedule	Late decisions/sign-off [**H, H**]	Organisation fails to adopt change [**L, L**]		The new system fail to reconcile business information [**M, M**]
	Legacy systems require changes which would be likely to delay the project [**H, H**]			Scope creep [**H, L**]
Operational	Communication risk between the project and the business [**M, L**]	Failure to deliver benefits as outlined in the business case [**M, L**]	No disaster recovery arrangements [**H, M**]	
		Inadequate training [**H, M**]	System malfunction in post-go-live phase [**L, L**]	
		The new system fails to provide appropriate financial information [**H, M**]		
		The information generated by the new system fails to comply with Data Protection Act [**H, L**]		
Business	Risk that sponsor cancels the project [**H, L**]	Lack of resources available from within the business to fill specific roles [**M, H**]		
	The business suffers 'Change fatigue' [**L, H**]			
	Business inadequately prepared to take on new solution [**M, L**]			
Organisational	Other projects that are happening in parallel within the business impact the ERP project [**H, H**]	Project resources required not available e.g. for training [**H, M**]	Project team 'burns out' [**M, M**]	Lack of resources in new technology areas being implemented due to their specialist nature [**H, L**]
				Project team turnover **M, M**

Notes: *'High' ('H'), 'Moderate' ('M') or 'Low' ('L') respectively to represent each 'Impact' and 'Likelihood' [Impact, Likelihood]. [a]Refer to the footnotes given in Table 2.

By attributing costs to each risk – based on its likelihood of occurring and its level of impact, it was possible to demonstrate the potential risk exposure to the overall programme. The RAF scores and associated cost (not shown here for reasons of confidentiality) were used as an important management decision-making tool for making key decisions about the direction of The Group's ERP implementation. The inclusion of costs encouraged the team to consider the full implications of each risk. One key point to note is that the risk management team accepted that the initial estimates of likelihood and impact of risk can be inaccurate. This meant that risk assessors did not feel initially pressured to spend time on estimating impact unnecessarily, as the risk management team understood that estimates could change over time, along with their associated costs.

The remaining three stages in the risk management process (cf. Figure 1) (determine approach to identified risk, track risk and mitigate risk) are not discussed in this article as they were company-specific solutions of less interest to generic practice, and company confidential. The first two stages have been presented because they provide generic risk analysis principles, using the new RAF for ERP implementation.

Using the above reporting structure, new RAF and risk control cycle the Group's ERP project was successfully commissioned; it has subsequently been reported that the application of the proposed risk management framework had brought many benefits. The team believed the RAF helped to successfully achieve the programme's objectives, provided a systematic approach to determining cost-effective risk reduction actions, provided a systematic approach to monitoring and reporting progress in reducing risk, helped identify timeframes for the evaluation of actions and results, encouraged the on-going, systematic evaluation and analysis of risks – whilst focusing upon a continual reduction in risk exposure.

5. Discussion

ERP implementation projects are inherently risky. Appropriate ERP system selection can considerably reduce subsequent implementation and operational risks. Although there are some frameworks available to help manage risk in implementation, they are typically too theoretical; and their usages are limited mainly due to lack of knowledge by the users. Therefore, a practical RAF to help manage ERP implementation risk was needed. This study proposed such a framework which contributed to the successful implementation of an ERP project in a UK-based energy service provider. In the study, using the new RAF, the risks were classified into external engagement, programme management, work stream and work package levels as well as technical, schedule, operational, business and organisational categories. The risks were analysed using the RAF, which enabled The Group to quantify risk by likelihood (L) and impact (I) on a high (H), medium (M) and low (L) severity rating. These results helped to develop responses against each risk and assign associated costs. The regular risk control cycles helped manage the changing risk up the organisational hierarchy and over time.

The newly proposed RAF integrates risk identification, analysis and control by classifying risk hierarchically (external engagement, programme, work stream and work package), which helps to allocate risks to specific stakeholders for effective mitigation and management. The RAF also categorises risk as technical, schedule, operational, business or organisational which helps one to analyse the impacts of risk factors and adopt effective control of all the risks. Understanding the specific nature of a risk helps one to quantify impact and likelihood and prioritise resource deployment for mitigating the risks. Relating risk control mechanism with organisational hierarchy helps appropriate management of risk from initial identification until closure of the specific risk. The attribution of cost to a risk further highlights its potential severity, and the regular cyclical assessments of risk ensures that up-to-date information is being used.

In risk management, the risk identification phase can have more significance in comparison to the risk analysis and response development phases, because if the risks are not identified correctly any subsequent sophisticated analysis techniques or management responses will be unlikely to produce the desired effects. On the other hand, appropriate risk identification can facilitate both appropriate subsequent analysis and management action. Our newly proposed RAF not only helps the stakeholders (client, consultant or ERP provider) identify the risks correctly, but also facilitates objective analysis and allows appropriate management of those risks.

This article contributes to rethinking the dominant classical models in ERP project management, as research scholars and practitioners need to integrate the multidimensionality of ERP project risks with the dynamics of risk management practices better. In order to address these ERP project issues, and to cope with the inherent risks, we recommend (1) the adoption of an integrative and systematic approach for managing risks, and (2) considering the ERP project as a mix of complex social processes (Winter et al. 2006).

This research study has enabled us to propose a pluralist and multi-faceted vision of risk management activities; depending on the risk ratings allocated to various project hierarchy and risk categories. Our study has provided concrete guidance about the introduction of ERP systems in organisations, as well as the management of associated risks throughout the project life-cycle. Inspired by this case study, companies can consider actions that may help to bring troubled ERP projects under control.

So far, this research study emphasises the relationship between risk management and the success of ERP implementation projects. It questions the assumptions underlying several studies that claim that good risk management is merely good IS project management (Kutsch and Hall 2005, Bakker et al. 2009) and fail to recognise that risk management itself should be a generic practice that should be practised in any large organisational change project. Because of the size and complexity of ERP implementations, they are unlikely to be achieved successfully if the whole enterprise into which it is being implemented does not consider the risk as part of a broader initiative, as provided by this new RAF.

6. Summary and conclusion

This article addresses the implementation issues and challenges of ERP projects. We have adopted an integrative and balanced approach in order to classify risks into four levels and five categories. First, by reviewing the literature, we identified generic risk factors of ERP projects. Second, using a case study, a five-stepped risk management process (Figure 1) and risk control cycle (Figure 2) were introduced. Third, by applying the generic RAF (Table 2) and risk assessment scoring (Figure 3), risk factors were identified and their likelihood of occurrences and impact were derived and ascertained for The Group (as per Table 3). We believe that such a framework is comprehensive, redundancy-free and easily transferable into a wider field. Not only does this article propose a RAF, but also it specifies and tests a systematic method of how to deploy such a framework. In summary, our article (1) adds to the disparate literature on the ERP implementation risks and (2) innovates by proposing and testing an integrative and comprehensive approach.

The literature review (Yusuf et al. 2004, Aloini et al. 2007, Malhotra and Temponi 2009) reveals that the key success factors for ERP implementation are: commitment from top management, selecting the appropriate systems and proper management of its integration with existing business information systems – including the reengineering of the business processes. Additionally, this study shows that managing ERP project processes, along with managing information technology and managing organisational transformation effectively makes implementation of ERP projects more successful.

In a proactive approach to risk management, all concerned stakeholders participate in risk identification and analysis for each phase of the project before making decisions on project variables (e.g. resource deployment and allocations, implementation methodology selection, contractors and supplier selection, etc.). The success of ERP implementation is partly related to the fact that the stakeholders understand and effectively carry out their ongoing responsibilities in the project (Malhotra and Temponi 2009).

ERP projects are technically complex, multidisciplinary, of long duration and are capital intensive; therefore, they can be characterised as highly risky projects. It is sometimes difficult to develop a firm project plan at the beginning of a project due to lack of information at the initial stage; and so, dynamic risk analysis can help to improve knowledge about the project and provide better plans as the project progresses. Although risk management practices increase the project cost in terms of deploying extra human resources and overheads, additional resources for risk mitigation, etc., the benefits (proactive approaches to prevent failure) will ultimately outweigh the costs. Consistent with Peng and Nunes (2009), we call for extending the risk management practices to the post-implementation period. This will help to ensure the sustainability of enterprise information systems. A further research avenue would be to determine the specific conditions under which risk management can be effective (Loch et al. 2006) as in The Group observed in our study.

Appendix. Questionnaire used to develop the ERP case study at The Group

Background

Brief company profile

Brief details of ERP project implemented

Risk management in ERP project implementation

Risk identification:

What risks are likely to occur in ERP implementation?

How was risk identified in the project? Was there a formal approach to identifying risk?

What risks were actually identified?

Who was involved in identifying the risk?

What are the issues and challenges in identifying risk?

Risk analysis:

How was the risk analysed?

Was there a formal approach to risk analysis?

Who was involved in analysing the risk?

What are the issues and challenges in identifying risk?

Risk control:

What measures can be taken to control risk when implementing ERP projects?

Was there a formal approach to controlling risk during implementation?

Who was involved in controlling risk during implementation?

How effective were the risk control measures in terms of accomplishing time, cost and quality targets of the ERP project?

Risk in ERP implementation

Based on actual ERP implementation experience what are the various risk events/factors across risk categories (technical, schedule, operational, business and organisational) and levels (engagement external, programme, work stream and work package).

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