Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 16 (2014) 542 – 552

Procedia Technology

CENTERIS 2014 - Conference on ENTERprise Information Systems / ProjMAN 2014 - International Conference on Project MANagement / HCIST 2014 - International Conference on Health and Social Care Information Systems and Technologies

A study to evaluate the effectiveness of simulation based decision support system in ERP implementation in SMEs

Mahmood Ali[a,*] and Joanna Cullinane[b]

[a]*College of Business Administration, University of Business and Technology, Jeddah 21361, KSA*
[b]*Business School, University of Greenwich, London SW9 7JY, UK*

Abstract

ERP system implementation is a challenging process and small medium enterprises (SMEs) face considerable challenges in implementing ERP system due to their limited resources and IT infrastructure. Still, due to their benefits, ERP systems are becoming an integral part of SMEs. This study evaluates the role simulation based modelling can play in assisting SMEs in ERP implementation. The key informants representing diverse backgrounds are interviewed to collected data. The findings of the research show that Key participants supported the idea of incorporating simulation based model during the implementation process since a simulation based approach make more sense since it will allow the implementation team to observe the implementation process and the role played by factors which are essential for the success of the implementation. Also, simulation model can also be useful in developing and analyzing different implementation strategies, predict efforts and resources needed for ERP implementation, which in turn can facilitate decision makers in adopting a ERP system or not.

Peer-review under responsibility of the Organizing Committee of CENTERIS 2014.
Keywords: ERP system; Small and medium enterprises; Decision Support Systems; Simulation Modelling

1. Introduction

The organisation's strategies for improved performance and efficient supply chain have forced them to seek ways to improve their operational performance by incorporating essential tools and programme such as ERP system. ERP system enhances the operational efficiency by integrating the different activities across the organisation thus streamlining the flow of information. It is due to their effective role that there are more than 200 ERP systems provider in the industry to cater the needs of the organisations. This growth may be due increased and the need of the greater visibility into business functioning. Nevertheless, whatever the cause of the growth, several researchers and practitioners have argued that ERP systems have actually been the most popular new business software of the last fifteen years [3, 5, 11, 16, 30].
ERP system support information sharing along an organisation's main process flow and thus help organisation to achieve better productivity and results [29]. ERP packages offer a 'workflow engine' which allow the generation of automated workflows according to business strategy and approval matrices so that information and documents can be routed to operational users for transactional handling, and information can be provided to managers and directors for review and strategic oversight [13].

Despite their benefits, ERP systems are known for their implementation challenges which can include system complexities, required organisational changes, need of skilled IT staff etc. Due to these challenges and the implementation

* Corresponding author. Tel.: +966 2 215 9161.
E-mail address: m.ali@ubt.edu.sa

Peer-review under responsibility of the Organizing Committee of CENTERIS 2014.
doi:10.1016/j.protcy.2014.10.002

complexities, the literature identifies that approximately 66 to 70 percent of ERP implementation projects were reported to have failed to achieve their implementation objectives in some way [8, 19, 26, 31, 33].

In addition to these concerns, the literature acknowledges that small and medium enterprises (SMEs) might face added constraints in ERP implementation. Beyond, the ordinary concerns that SMEs have lesser resources, there might be the added complication that SMEs are more likely to be lacking modern information technology infrastructure and experienced IT staff, and might have less openness in their attitudes to the perceived usefulness of new technology. These constraints might cause the 'average' SMEs to refrain from adopting an ERP system or, even if they did adopt, the constraints might increase the probability of implementation failure. For SMEs, it is noted that a failed implementation might generally have more catastrophic consequences than for a larger organisation, even perhaps leading up to bankruptcy [5].

Given the potentially high cost and low success rate, it is necessary that causes of the problems and high failure rate to be better understood and through this understanding, solution leading to greater success may be found [7]. As a consequence, ERP implementation has been a focal point of much academic research. Multiple streams of research exists on the ERP implementation and critical factors required for its successful implementation as well as impact of ERP on organisational performance [2, 14, 15]. For example, several studies have identified the critical success factors (CSF) needed to enable project managers and higher management to improve ERP implementation projects. In addition, to gain the understanding of the ERP implementation, different models have been proposed [1, 18, 23]. However, most of these models are theoretical and since the ERP implementation process is a dynamic and real- life process, a practical tool or a method can be ideally assist in implementation process. One of the methods which have been applied in many industries is simulation modelling. Since ERP implementation involves investing resources in the form of time, money and manpower, it absolutely make sense to simulate the ERP implementation process before doing in real life, which in turn can assist in studying the implementation process, problems can be forecasted, thus potentially saving organisations resources. Therefore this research, study the role simulation modelling can play in ERP implementation in SMEs, how it can be effectively applied and basic construct of good simulation model. A qualitative approach is adopted which involves key informant interviews to further gain insight of the implementation process and simulation modelling.

2. Issues in ERP implementation

ERP system is complex, and implementing a system can be difficult, time consuming and expensive project for an organisation [25]. There are several reasons for complexities of the ERP system which makes it implementation more challenging. One of the reasons is the functionalities offered by ERP system which usually covers thousands of business activities [10]. They found that complexities and associated challenges in implementation are due to the nature of ERP which treat the cross-organisational business processes in a value web as the fundamental building block of the system, deliver a shared system which lets the business activities of one company becomes an integral part of the business of its parameters. This creates system capabilities far beyond the sum of the ERP components' individual capabilities and each functionality offered matches the need of the unique stakeholders group. In addition, ERP system requires regular adjustment to the business needs to mirror rapidly-changing business requirements [10].

Since ERP system are developed on 'best practice' intra-organisational functional models and so implementing ERP often requires organisations to restructure their business processes around those practices. Not surprisingly then, Maguire et al. (2010) found that the introduction of ERP system result in key organisational changes which, if not managed carefully, can actually result in conflict within organisation. This conflict is especially evident in relation to the questions of how to integrate the ERP system, what should happen to the legacy system, and how the business processes of the organisation should be revised. This necessary realignment is often cited as the source of many of the implementation failures [27].

It is due to aforementioned reasons that a study by Nelson (2007) found that only 34 percent of IT projects initiated by Fortune 500 companies are successfully completed, and Muscatello and Parente (2006) found that ERP implementation failure rates were around 50 percent including numerous examples of failed implementation cited in literature, such as Dell, Waste Management, Mobile Europe and Hershey [10].

3. Simulation modelling

Simulation modelling is the imitation of operation of real world process or system, played overtime. Simulation has long been a significant tool for facilitating decision making and improving processes [12]. Simulation modelling is applied in different field across the industry. Levy et al. (1988) suggested that the simulation is essential to understand the relationships within a complex system, to experiment with the model to assess the impact of actions, options, and

environmental factors, to test the impact of various assumptions, scenarios, and environmental factors and to predict the consequence of action on a process.

Balakrishnan et al. (2007) are also proponents of simulation, they suggested following advantages of simulation modelling:

- A simulation model can be made flexible enough to easily accommodate several changes to the problem scenario;
- it can be used to analyse large and complex real-world simulations that cannot be solved by using conventional decision model;
- Simulation allows 'what-if' types of questions;
- Simulation modelling does not interfere with the real-world system;
- Simulation allows researchers to study the interactive effects of individual components or variables to determine which ones are important; and "Time compression" is possible with simulation.

In next section, methodology adopted for this research is discusses followed by data collection interview process and a discussion.

4. Methodology

This study adopts key informants interview based qualitative method approach. Qualitative methods is suitable for this study since it assists in determining the 'why' and 'how' questions. Benbasat et al. (1987, p.368) explained that a method such as this allows examination of 'a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or few entities (people, groups or organisation)'. The key purpose of this method is to obtain in-depth understanding of the complex phenomenon, both in and of itself and in relation to its broader context [24].

Four participants were selected using convenience sampling. For the interview process, two sets of questions were designed. First set, called the 'warm-up', was structured and designed to collect basic information about the participants, SMEs and ERP implementation. The warm-up questions were sent to the participants in advance before the main interviews take place. For the main interview, the second set of questions was designed in a semi-structured interview format. In semi-structured interviews, the researcher had a list of themes and questions to be covered. The interviewee was given an opportunity to talk freely about events and behaviour. This is also called as an informant interview since it is the interviewee's perception that guides the conduct of the interview. This semi-structured format is suitable for this research since the interview process was performed to elicit participant's views on the role simulation model based decision support system (DSS) can play during ERP implementation, critical factors to consider in model development and performance measures. In addition, information about participants' experiences, their views on viability of generic DSS and suggestion for model improvement were also obtained.

The interviews were audio recorded with participant's consent and they were assured of complete confidentiality. Each interview process lasted for 45-90 minutes. The interviews were transcribed and analysed using a narrative method in NVivo 9 software. A narrative method of qualitative data analysis is based on data being coded and analysed to identify and explore themes, patterns and relationship.

5. Organisations' Background

The first SME, denoted CS1, is an IT company that designs and manufactures computer-networking equipment, such as routers and switches, for corporate, educational, and governmental clients. The company was setup in 2002 and is based in San Jose, USA. The company literature describes CS1 as "a global technology leader that data centre, service provider and enterprise customers rely on when the network is their business. The company's high-performance solutions are designed to deliver new economics by virtualizing and automating Ethernet networks".

The second SME, CS2, is based in UK and provides software solutions and services to the leisure industry. The company supplies membership management and booking systems to health and fitness groups, leisure centres, trusts, universities, and various private and single site clubs. For multi-site operators, it offers central database solutions that facilitate central and cross-site online bookings, membership management, central administration, CRM, marketing, and reporting. CS2 also provides a range of systems and software based solutions, such as e-registration, cashless catering payments, and biometric recognition for schools.

The third SME, CS3, is located in the UK, and its main business is providing software application management to educational institutions. In addition, CS3 carries out research, consultancy, and advisory work related to organisation's IT

needs for schools, colleges, careers services, professional bodies, and employers. CS3 also offers continuing professional development that can be customised to meet the needs of individual customers.

The last SME, CS4, is located in Canada and provides a range of financial services to its clients such as financial planning, insurance services and portfolio management.

Table 1 Organisational features of participating SMEs

	Case Company 1	Case Company 2	Case Company 3	Case Company 4
Participant's Job Title	MIS-Manager	SQA-Analyst	Net-Developer	BI-Administrator
Industry	IT	Leisure Industry	Education	Financial
Location	USA	UK	UK	Canada
No. of employees	118	220	240	150
Total sales/Turnover	Confidential	-	-	-

6. Key Informants

6.1 Key Informant 1 – "MIS-Manager"

The Key Informant 1, works in CS1 as Management Information System (MIS) manager, and has rich experiences in programming, networking, and information services, accumulated through 13 years working in the IT field. As the MIS manager, Key Informant 1 is responsible for implementing IT infrastructure in CS1. He also manages new technology introductions and plans how it meets CS1's business needs. MIS-Manager liaison with business manager and IT team in CS1.

6.2 Key Informant 2 – "SQA-Analyst"

The Key Informant 2, works a SQA-Analyst in the CS2, with 16 years of experience in software development and IT management. SQA-Analyst's main role includes software quality assurance, process formulation, IT strategy formulation and IT planning and budgeting. SQA-Analyst has participated different stages of IT projects, for example, B2B transactional services, conceptualisation prior to implementation and post-implementation SQA-Analyst is the implementation team leader for the ERP implementation in CS2.

6.3 Key Informant 3 – "Net-Developer"

The Key Informant 3 works as a Net Developer in CS3. He has accumulated good experiences by working 11 years in IT field taking different roles and participating in a variety of projects. His main area focuses on education sector. He has a leading role in CS3's ERP implementation, starting from initial evaluation of business needs, to ERP software selection, then to work with ERP vendors for ERP implementation.

6.4 Key Informant 4 – "BI-Administrator"

The Key Informant 4 works as a BI-Administrator in CS4. Before joining CS4, he has worked 18 years on different software applications including Clarity, Business Objects XI and SAP Business Objects FMS applications. BI-Administrator is the key participant in the acquisition and implementation of CS4's new ERP system. During the implementation, he is the team leader responsible for configuring the software, and supporting business processes and resource allocation.

7. Key Themes

This section discusses the key themes generated from the key informant interview process. Empirical data collected from interviews provides the basis for generating the key themes.

7.1 Scope of a simulation based decision support systems

As is discussed in previous sections, ERP implementation is a challenging process due to complexities involved during implementation. Organisations are very often either reluctant to implement ERP systems or overly rely on external support to avoid failure. The external support is sought from ERP vendors, ERP forums, and online support forums. According to the Key Informant 1 who is the MIS-Manager, '*the prediction model can be really useful'* during the implementing process of ERP project. Key Informant 1 further elaborated on how these types of model can be effectively used:

'In fact if I had such a model, I would have been more successful in getting my project completed in time. In short, with such a model, I can convince my management in a very short time about the use of resources, and results of implementation. At the same time, if I had the model and I can know in advance that in this type of implementation, how much time should be allocated and what will be the predicted results, then we could be confident of our efforts'.

While Key Informant 3, the Net-Developer, agreed with the practical application of the model, but suggested that such a model's potential is limited when it is applied in the IT industry:

'they are quite useful especially in the IT field. They can be helpful in finding out how [a] system works and [can be] implemented. They are quite useful and can be a good tool to convince the top management about the prospect of [the] project'.

Key Informant 4, the BI-Administrator, expressed his views on the scope of a prediction model and the role it could play:

'Whenever there is an IT related project to improve the functionality of the company, if we are using a working simulation model then achieving implementation success is always easier. Such as, in our case, we had [a] limited number of people in our department and we did not follow any particular implementation model but if we had a simulation model, our implementation might have been quicker, cost effective [and] with better user success factors, so it all depends but definitely if we had a model things would be better'.

Further Key Informants agreed that a prediction model could be valuable for ERP implementation. Key Informant 1, the MIS-Manager, while recognising the operational value of prediction models, suggested that:

'Definitely, I think the model can be very useful and if you give me this model today and I have a project coming up tomorrow, I will be glad to use it, rather sell the project based on the outcome prediction from the model and convince my upper management. So, yes, I think they can be useful for SMEs'.

However, Key Informant 2, the SQA-Analyst argued that a prediction model can only bring operational value if it is industry specific and respects the nature of the industry where it is:

'if it is relevant to my industry and if embodies the industry requirement and it guides me in simulation process and step to take, than I am sure that they can be [of] good use, and if they don't, then I am afraid that it will not [be] of much help to me'.

Since a decision support model simulates or copies the behaviour of the system under study, Key Informant 3, the Net-Developer suggests that 'th*ey can give you an idea as how the system will perform in the real life. So I think they have a quite useful value'.*

Key Informant 4, the BI-Analyst considers a prediction model a value adding model that can enhance implementation experience:

'Definitely, they have practical value, before the implementation goes live. If we have a model then we can implement in due time. So the value is there, but only up to the go-live date of the project. After that its end users, IT, functional consultants, they will take it from there but up to that point, yes it is added value'.

7.2 Critical factors in simulation model development

The four key informants were asked which factors they consider essential in developing simulation based model. Key informants proposed different critical factors which can essentially contribute towards developing a simulation model and therefore should be considered part of model. One factor which was most commonly agreed was *Top Management support*, which can be influential in initial planning and groundwork phase, mobilising resources and up to the system go-live phase.

Key Informant 2, the SQA-Analyst further explained as why the top management support can be critical to project success:

'I would rate top management support extremely critical because if top management is not with your vision … then [your] cause can be lost. In lots of cases, moral support and financial support comes from the top management. Top management gives the strategic directions, therefore when the project is not on right path, only top management can guide you. Therefore, I think top management is the key factor to carry out project and to implement it'.

Key Informant 3, the Net-Developer also considers Top Management support as a factor that is critical to the success of the ERP implementation:

'top management is quite critical to any project. Basically, the support of the top management can make the project successful. In my view, among these five factors, top management is the most important'.

In contrast, Key Informant 4, the BI-Administrator argues that Top Management is only required at the crucial phases during implementation:

'it is usually not required all the time but it is needed at the most critical phase as whenever there is a roadblocks due to resources unavailability, cost, technical issues etc. In a situation when the roadblock cannot be resolved by technical member of the team, the project manager, or the end user, it is where we need top management support at those critical moment.'

Next important critical factor highlighted by key informants is 'Users' and according to them it is an essential criterion for *things to go right* during implementation. Two Key Informants particularly acknowledged the effectiveness of the users during implementation:

'Users are also very important because what they will be doing is different from what they have been doing so far. Depending on the organisation's culture, sometimes users are reluctant to change as they want to do things in a certain way in which they have been doing for a long time. In other cases, there are users who are very open to change and they easily adapt to the new project. (Key Informant 1, the MIS-Manager)

Similarly,

'Users or the stakeholders are extremely important because when they get involved in the project, they can provide essential support to the project. [The] project manager can get input from user and this lays the foundation of the good project. A good stakeholder team, with good project management, will deliver results'. (Key Informant 2, the SQA-Analyst)

Key Informant 3, the Net-Developer adds:

'Users are important in a sense that system implemented is for their use and therefore their feedback is essential in improving the new system'.

In general, Key Informants mostly viewed Users factor as an essential from the point of view of their role in adapting to new technology and experimenting with new ERP system. It is observed that users can be classified in two groups; one who are reluctant to change and others who are open to change and ready to adapt new technology. Further, during implementation, users can provide essential feedback that can guide the project manager, which, as according to a Key Informant, is the most valuable input that one can get during implementation.

Another factor mentioned was project management, and according to Key Informant 4, the BI Analyst, *'project management is the backbone of the project'*. The BI Analyst further explains that project management covers a wide spectrum of issues during implementation, and if carried out in an efficient manner, it enhances the likelihood of success. Due to its wide reach and coverage, project management has developed into specialised 'science'.

In addition, availability of IT infrastructure and resources are also considered essential factor by the participants. According to Key Informant 2, the SQA-Analyst, the critical factors IT and Vendor Support need to work together during implementation. While, Key Informant 3 the Net-Developer, ranked IT 'as *the most important after top management'*.

Key Informant 4, the BI-Analyst suggested that the significance of IT is that it usually varies between organisations depending upon their existing infrastructure. According to this Key Informant:

'...it is very important but it varies from organisation to organisation. The reason behind it is that the new IT implementation is critical to your existing model i.e. what existing application and databases is utilised. Therefore you need a database and infrastructure which will plug in [with the] existing model without any modification. If you can do that, this will decide that what database and infrastructure you should go with for this implementation.'

Due to complexities involved in implementation, organisations usually heavily rely on ERP vendor's support to setup IT infrastructure for ERP implementation and assistance during implementation. Most importantly, Vendor Support helps SMEs customise the ERP system to match the actual features of existing processes in organisation. All the Key Informants stated that Vendor Support is essential for project success. Key Informant 1, the MIS-Manager termed it 'very essential' during their implementation, due to their limited IT set up:

'Vendor's support in my case is extremely important and I think perhaps it is true for many organisations since many organisations rely on external teams of consultants to implement the project. So in that sense if you don't have support of the vendors then your project may not be successful.'(Key Informant 1, MIS-Manager)

While according to Key Informant 2, the SQA-Analyst, both right Vendor Support and right IT infrastructure are mandatory for a successful ERP implementation:

'...according to the requirement of the project, you need right infrastructure and right kind of support from consultants or external vendors. It is something which is mandatory for the project survival; and to keep project on track. [A] project needs certain specific kind of infrastructure and if you are unable to provide resources, essential tools or techniques than the project will not go anywhere.'

Similarly, Key Informant 4, the BI-Administrator also agreed on the role of Vendor Support during implementation:

'vendor's support is critical because if you end up in a situation where you are getting an error, [If] your application is not running, or your database is popping out an error that your technical team cannot resolve, [then] in that case you need your vendor to jump in and resolve the situation, so [the] quicker you get those things resolved, the better it is for your project. So their support is very important when you get into these kinds of situations'

During the interview process, the Key informants were also asked to identify other critical factors which are important to ERP implementation. According to Key Informant 1, the MIS-Manager:

'organisational culture i.e. if an organisation is willing to change, and Business process reengineering could be [another] important factor.'

Key Informant 2, the SQA-Analyst proposed 'quality factor' as another important critical factor. He explained:

'It is because these days you have to finish the project in time with reasonable cost and within the parameters of quality. If you are able to deliver the project but you don't have requisite quality then obviously it will run into problems. So if the quality of implementation is not good then all these resources will go to waste.'

Key Informant 3, Net-Developer recommended *effective communication* and *business planning* as additional important factors, while Key Informant 4, the BI-Analyst suggested functional consultant as an important factor, and explained:

'*In an organisation you have end users and [the] IT [team]. The common problem is communication language between them since they apply their own terminologies and jargon in daily work life. This can create a confusion. So we need someone who is somewhat familiar with IT and with the product that you are delivering and its functionality, so they can translate that information for IT. Functional consultants are very important and play a key role in this kind of situation during implementation'*.

7.3 Critical factor's attributes

In order to gain further insight of the basic critical factors of the simulation model, the Key Informants were asked to suggest attributes that define those critical factors in their opinion. These are reported in the following section and summarised in Table 2:

7.3.1 Top Management (TM) attributes

According to Key Informant 1, the MIS-Manager: *'their main attribute is how adept the management is with technology and advancement in the IT field including ERP. In addition, their past implementation experience is an essential'*.

While according to Key Informant 2 the SQA-Analyst, 'top management's v*ision and strategic direction, financial support, proactive, inquisitive and project alignment capabilities'* are important attributes.

For Key Informant 3 Net-Developer, 'top management *availability; as [and] when needed to make important decisions, their support and skills in managing project'* are essential attributes.

Key Informant 4 BI-Analyst suggested top management's support and availability were both jointly important attributes and added communication features of top management:

'top management their level of support is very important since they are decision maker. In addition, their availability is also essential when they are needed since they are busy people. Also their effectiveness and communication with the team, with the vendor or with end user is also important'.

7.3.2 Users attributes

Although all Key Informants reached an agreement on the importance of critical factor Users, they identify different attributes under it: *'Users attributes can be communication, open to learning, honest feedback, openness. (Key Informant 1, MIS-Manager)*

'…training, minimal resistance to change, learning' (Key Informant 2, SQA-Analyst)

'availability and, learning and communication are main attributes' (Key Informant 4, BI-Analyst)

7.3.3 Project Management (PM) attributes

Key Informant 4, the BI-Analyst, classified project management as '*the backbone of the project'*. Due to the significance and the nature of Project Management, a wide range of attributes were suggested:

'...the most important PM attribute is their experience in implementation.' (Key Informant 1, MIS-Manager)

'...industry knowledge, experience and [being] well versed with project management methodologies, [plus] public dealings, ready [to] absorb lot of things, [being] organised, [having] excellent communication skills' (Key Informant 2, SQA-Analyst)

'...good resources utilisation skills, experience, skills, time management'. (Key Informant 3, Net-Developer)

'...effective communication and availability on time is essential. Their important attributes include [being] clear in their thinking and understanding, with abilities to explain the process from technical and functional point of view.(Key Informant 4, BI Analyst)

7.3.4 Information Technology (IT) attributes

Attributes for IT factors are mostly related to the issue of reliability of the infrastructure. Key Informant 1 the MIS-Manager suggested for example, that *'IT related attribute include flexibility of the infrastructure and database. If the database is complete and/or being updated. Data measurement is also important attribute for the success of the project'.* According to Key Informant 3, the Net-Developer, IT attributes are '*reliability, scalability, and ability to withstand stress*.'

Key Informant 4, the BI-Analyst suggested *'reliability, authentication of end users and a backup plan'* as essential attributes of the IT factor.

7.3.5 Vendor's Support (VS) attributes

Key Informants considered the following attributes significant for Vendors Support:

'...reliable, and fulfil requirement within organisation budget'.(Key Informant 1, MIS-Manager)

'...system support and on-time availability in case of problems'.(Key Informant 3, Net-Developer)

'...quick turn-around time and on-demand support...'.(Key Informant 4, BI-Analyst)

Table 2 Critical factors and their attributes proposed by Key Informants

	TM	Users	PM	IT	VS
MIS-Manager	i). Tech savvy ii). Past implementation experience	i).Communication skills ii).Open to learning iii). Feedback	i). Experience	i). Flexibility of infrastructure and database	i). Reliable ii). Ability to fulfil requirement-s while staying inside budget
SQA Analyst	i).Vision ii). Financial support iii). Proactive Inquisitive	i). Training ii). Minimal resistance	i).Industry knowledge ii).Experience iii). Excellent		

			communication skills		
Net Developer	i). Availability (when needed) ii). Support iii). Project management skills		i). Good resources utilisation skills ii) Time management skills	i).Reliability ii).Scalability iii).Ability to withstand stress	i).Systems support ii).On-time availability
BI Analyst	i). Availability (when needed) ii).Communication skills iii). Effectiveness in dealing with team and vendors	i).Communication skills ii).Availability (when needed by IT team)	i).Effective communication skills ii).Clear Understanding of the project	i).Reliability ii).Authentication of end users Back-up plan	i).Quick turn-around time ii).On-demand support

7.4 Performance measures

In the next stage of interview, Key informants were asked for their opinion as what is their preferred performance measurement criterion. Key Informant 1, the MIS-Manager rated *performance level* to be the most important measure:

'Achievement was most important for me. Achievement in the sense that we had some goals at start which we attempt to achieve and if those goals are not achieved then I will not consider the project as successful'.

Key Informant 2, the Net-Developer evaluated *Time or Project Duration* to be the most important measure:

'…time is most important factor, since implementation project must deliver on time, therefore time is the most important factor, while cost and achievement may vary according to the demands of the implementation'.

Key Informant 4, the BI-Analyst identified *project duration* and *performance level* the most important measure.

It is observed that Key Informants identified performance measures influenced by the organisational and technological context of ERP implementing organisations. It is interesting to observe that project cost was not the primary concern for any of the Key Informants, despite the fact that ERP implementations are known for their high implementation cost. Nevertheless, one Key Informant argued that all three variables are interrelated and cannot be studied in an individual context.

8. Discussion

The primary purpose of this research is to study the potential role simulation-based decision support systems can play in ERP implementation. Whilst the studying ERP implementation process is not the focus of this process, the Key Informants are allowed to share their experiences accumulated from ERP implementation, raise issues and concerns encountered during implementation, as well as solutions to these issues.

The four Key Informants interviewed, with a total sixty years of experience in IT field, recognise the benefits that simulation based DSS can bring to ERP implementation. They agreed that DSS can be an useful tool prior to and during ERP implementation, and can be used to predict efforts and resources needed for an ERP implementation, which facilitate decision makers adopting a ERP system or not. According to Key Informant 1, the MIS-Manager, when organisation utilise DSS implementation can be accelerated, and cost effective with increased users' satisfaction. Further, Key Informant 4, the BI-Administrator suggested that presence of model could give implementation team a confidence to take initiatives. However, Key Informant 2, the SQA-Analyst was of the view that organisations SMEs needs to be cautious before adopting the model since a model has to be expert at particular project and industry. In addition, he warned, too much reliance can be 'injurious' to the project and outcomes.

After discussing the role a prediction model could play in implementation, the next question in the interview was focussed on finding out participants' views on which factors they consider critical for the success of DSS and implementation. It was observed that Key Informants generally agreed on certain factors which they considered can be more critical in DSS development. It was generally agreed that top management support is essential for project success. However, according to one Key Informant top management support is not required most of the time; however, it might be needed at critical stages when there are *roadblocks* in implementation. As literature also suggests that too much top management support can be dysfunctional and lead to failures [9, 17]. Whilst Young (2006) suggests that project can succeed without following general prescription for top management support. Similarly, Key Informants considered experienced project management as *a backbone* of the project, while Vendor Support was also rated as an important constituent since

organisation often lack the understanding of the complexities that are brought in ERP system. Users were identified from the point of view of their role in adapting to new technology and experimenting with new ERP system. It was suggested that Users can be grouped in two groups; one who are reluctant to change and others who are open to change and ready to adapt new technology. Key Informants stressed upon the importance of feedback and input by users in improving the implementation process. While IT was termed as second most important critical factor after top management since it ensures the availability of right infrastructure before embarking on ERP implementation. According to a Key Informant it is mandatory for the project survival, and to keep it on track. Additional factors suggested include organisational culture; innovative, dynamic, teamwork or how much they are ready to change and adapt new technologies, Business Process Reengineering (BPR); restructuring organisation setup for new ERP system, quality; maintaining certain quality standards, effective communication; including vertical communication and horizontal communication and functional consultant; to act as bridge between IT/VS and users.

Key Informants were asked to suggest any additional factors they consider which can be useful in developing simulation model for ERP implementation. It was suggested that addition of certain critical factors could give a new dimension to the model. Critical factors such as organisational change capacity and BPR could provide more predicting power to the model. In addition, it was suggested that involving some kind of method to seek end users' feedback in the model can also be beneficial. This could assist in keeping project on track and advise management if the project is progressing as planned or if there any changes that need to be made.

9. Conclusion

Understanding the complexities of ERP implementation is widely researched topic. Literature suggests that the probability of failed implementation is usually high and if even successful, the cost of implementation can be enormous. It is generally observed in the literature that there are numerous studies on ERP implementation including different implementation models and strategies proposed. However, due to practical and dynamic nature of the ERP implementation, a simulation based approach make more sense since it will allow the implementation team to observe the implementation process and the role played by factors which are essential for the success of the implementation. Simulation model can also be useful in developing and analysing different implementation strategies and observe the results. Therefore to analyse the role simulation model based DSS can play in ERP implementation, this exploratory study adopts key informants interview process. This process not only confirms the there is likelihood that a simulation based DSS can be very useful in ERP implementation, but also the participants showed interest in applying this type of model in their implementation process. Drawing from the findings of this study, a simulation based DSS can be developed based on the critical factors highlighted by the participants, which can further enhance users experience in ERP implementation and assist in overcoming the intricacies on implementation process.

References

[1] Akkermans, H.A. and van Helden, K. Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors. European Journal of Information Systems 2000;11:35-46.
[2] Al-Mashari, M., Al- Mudimigh, A. and Zairi, M. ERP: a taxonomy of Critical success factors. European Journal of Operational Research 2003:146:352-364.
[3] Baiyere, A. ERP evolution and SMEs constraints'. IADIS Information Systems Conference 2012; Berlin, Germany.
[4] Balakrishnan, N., Render, B. and Stair, R.Managerial Decision Modelling with Spreadsheets, Prentice Hall, NJ;2007.
[5] Beheshti, H.M.What manager should know about ERP/ERPII. Management Research News 2006;29(4):184-193.
[6] Benbasat, I. Goldstein, D. K. and Mead, M. The Case Research Strategy in Studies of Information Systems.MIS Quarterly1987;11 (3):369-386.
[7] Calisir, F., and Calisir, F. The relation of interface usability characteristics, perceived usefulness, and received ease of use to end-user satisfaction with enterprise resource planning (ERP) systems. Computer in Human Behaviour 2004;20:505-515.
[8] Carlo, M. Enterprise software has to fit like a good suit. Advanced Manufacturing [accessed on 13th July 2010]. available at http://www.automationmag.com/erp-software.html.
[9] Collins, T. and Bicknell, D.Crash: ten easy ways to avoid computer disaster. London. Simon and Schuster;1997.
[10] Dave Daneva, M. Lesson learnt from five years of experience in ERP requirements engineering, in: Proceeding of the 11th IEEE International Requirement Engineering Conference 2003;45-54.
[11] Ehie, I.C. and Madsen, M. Identifying critical issues in ERP implementation. Computer in Industry 2005; 56: 545-557.
[12] Gupta, N. and William, E.J. Simulation improves services and profitability of an automobile service garage', Proceeding of the 16th European Simulation Symposium 2004.
[13] Hirt, S.G. and Swanson, E.B. The maintenance implication of the customisation of ERP software. Journal of Software and Evolution: Research and Practice 2001;13:415-9.
[14] Hitt, L.M., Wu, D.J., Zhou, X.,. Investment in enterprise resources planning. Journal of Management Information Systems 2002;9:71-98.

[15] Holland, C.P. and Light, B. Global enterprise planning implementation, in: 32nd International Hawaii Conference: HICSS'99, Big Island, Hawaii, 1999.
[16]Kamhawi, E.M. Enterprise resource planning systems adoption in Bahrain: motives, benefits, and barriers. Journal of Enterprise Information Management 2008;21(3):310-334.
[17] Keil, M. Pilling the plug: software project management and the problem of project escalation. MIS Quaterly1995;19(4):421.
[18] King, S.F. and Burgess, T.F. Beyond critical success factors: A dynamic model of enterprise system innovation. International Journal of Information Management 2005;26: 59-69.
[19] Lewis, B. The 70-percent failure, InfoWorld, [accessed on 13th July 2010] available at http://www.infoworld.com/articles/op/xml/01/10/29/011029opsurvival.html.
[20] Maguire, S., Ojiako, U. and Said, A. ERP implementation in Omantel: a case study. Industrial Management and Data Systems2010;110(1):78-92.
[21] Muscatello, J.R. and Parente, D. H. Enterprise resource planning: a post implementation cross case analysis. Information Resources Management Journal 2006;19: 61-80.
[22] Nelson, R.R. IT project management: Infamous failures, classic mistakes, and best practices. MIS Quarterly Executive2007; 6(2): 67-78.
[23] Parr A., Shanks G. and Darke P. Identification of necessary factors for successful implementation of ERP systems, In New Information Technologies in Organisational Processes', Ngwenyama, O., Introna, L.D., Myers, M.D. and DeCross, J. (ed.), Kluwer Academic Publishers, Boston, 1999. 99–119.
[24] Patton, M.Q. Qualitative Research and Evaluation Methods. Thousand Oaks, CA Sage Publications;2002.
[25] Shehab, E.M., Sharp, M.W., Supramaniam, L. and Spedding, T.A. Enterprise resource planning: an integrative review. Business Process Management Journal2004;10(4):359-386.
[26] Shores, B. Failure rates in global ITS projects and the leadership challenges. Journal of Global Information Management2005;8(3):1-6.
[27] Soh, C., Kien, S.S. and Yap, J.T. Cultural Fits and misfits: is ERP a universal solution?. Communication of ACM 2000;43(4):47-51.
[28] Stake, R. E. Case studies' in N. K. Denzin, & Y.S Lincoln (Eds.), Handbook of qualitative research.236-247.Thousand Oaks CA: Sage Publications; 1994.
[29] Van der Aalst, W.M.P. and Weijters, A.J.M.M. Process mining; a research agenda. Computer in Industry2004;53(3):231-244.
[30] Wagner, ELE., Scott, S.V.and Galliers, R.D. The creation of 'best practices' software: myth, reality and ethics. Information and Organisation2006;16(3):251-275.
[31] Ward, J., Hemingway, C. and Daniel, E. The framework for addressing the organisational issues of enterprise systems implementation. Journal of Strategic Information Systems2005;14(2):97-119.
[32] Young, R. How board and senior management have governed ICT projects to succeed (or fail)', Standard Australia, Sydney;2006.
[33] Zabjeck, D., Kovacic, A. and Stemberger, M.I.The influence of business process management and some other CSFs on successful ERP implementation. Business Process Management Journal2009;15(4):588-608.