Investigating Enterprise Resource Planning Adoption and Implementation in Service Sector Organisations

A thesis submitted for the degree of Doctor of Philosophy

by

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"O my Lord! advance me in knowledge."
[*Surah Ta-Ha: Ayah 114*]

A

PhD Abstract

This thesis investigates Enterprise Resource Planning (ERP) adoption and implementation in Service Sector Organisations (SSOs). ERP is a business management system that has emerged to support organisations to use a system of integrated applications to enhance their Information Technology (IT) infrastructures, enhance business processes and deliver high quality of services. Regardless of the fact that several other sector organisations have adopted and implemented ERP systems, its application in SSOs is rather inadequate. Among other reasons, two core rationales can be attributed to the latter fact – firstly, SSOs lack the sufficient knowledge, expertise and training to implement such sophisticated integrated systems and secondly, the top management lacks the ability to take appropriate decisions for ERP adoption and implementation. However, merely focusing on a number of factors influencing ERP adoption and implementation may not be suffice, as there is a need for a systematic decision-making process for adopting and implementing ERP systems in SSOs. The limited number of ERP systems' applications in SSOs has resulted in inadequate research in this area with many issues, like its adoption and implementation requiring further exploration. Despite, the implications of ERP systems have yet to be assessed in SSOs, leaving ample scope for relevance and producing a unique piece of research work. Thus, the author demonstrates that it is of high importance to investigate this area within SSOs and contribute towards successful ERP adoption and implementation.

This thesis makes a step forward and contributes to the body of knowledge as it: investigates factors influencing the decision-making process for ERP adoption and implementation in SSOs, prioritises the importance of factors influencing ERP adoption and implementation, evaluates ERP lifecycle phases and stages, maps the ERP factors on different phases and stages of the ERP lifecycle, and in doing so, to propose a model for ERP adoption and implementation in SSOs. The author claims that such an ERP adoption and implementation process in SSOs is significant and novel as: it extends established norms for ERP adoption and implementation, by including Analytical Hierarchy Process (AHP) technique for prioritising the importance of factors, thus, facilitating SSOs to produce more robust proposals for ERP adoption and implementation. The author further assess the proposed ERP adoption and implementation model by using a qualitative, interpretive, multiple case study research strategy. Findings from two case studies demonstrate that such a systematic approach contributes towards more robust decisions for ERP adoption and implementation and indicates that it is acceptable by the case study organisations. The thesis proposes, assesses and presents a novel model for ERP adoption and implementation in SSOs and contributes to the body of knowledge by extending the literature.

A

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It would not have been possible to write this doctoral thesis without the help and support of the kind people around me. However, I have full belief and faith that Almighty ALLAH for his help and support me during my life.

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I am most grateful to give deepest heartfelt gratitude to my mother for her personal supported prayed and loved and great patience at all times before she dead. My father, brothers and sisters and mother-in-low have given me their support, help and pray during this doctoral thesis.

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D

Dedication

I dedicate my thesis to my mother's soul, and my father, brothers, sisters, mother-in-low, *my wife and my children who always love and support me, especially at this important stage in my life.*

شكر وإهداء

الحمدالله كما ينبغي لجلال وجهه وعظيم سلطانه وله الحمد والشكر على نعمة التي لا تعد ولا تحصى

إلى أمي رحمها الله
التي راني قلبها قبل عينهـــا وحضنتني أحشاءها قبل يدهـا
إلى من نذرت عمرها في أداء رسالة صنعتها من أوراق الصبر وطرزتها في ظلام الدهر
على سراج الأمل بلا فتور أو كلل رسالة تعلم العطاء كيف يكون العطاء
وتعلم الوفاء كيف يكون الوفاء إليك أمي أهدي هذه الرسالة
يا من أعطتني بلا حدود يا من علمتني أبجدية الحروف
يا من علمتني الصمود مهما تبدلت الظروف

أخط كلمات ملؤها شكر وعرفان
لأنك علمتني بأنه مع بزوغ كل فجر تتجدد نسمات الأمل لأنك علمتني بأن غاية الحياة ليست المعرفة بل العمل
لأنك علمتني بأن أسعى للنجاح وليس للفشل فإليك يا من أنرت دروب حياتي المظلمة
إليك عهدي بأن أذكرك مع كل نبضة من نبضات قلبي إليك عهدي بأن أذكرك ما دام الدم يسري في شراييني

فيا ليتك معي حاضرة تذوقين النجاح اللي من دونك ينقصه الكثير

اليـــكـ أبي الحبيـــب
إلى من كلل العرق جبينه.. وشققت الأيام يديه
إلى من علمني أن الأعمال الكبيرة لاتتم إلا بالصبر والعزيمة والإصرار
الى من علمني أن أصمد أمام الأمواج إلى من اعطاني ولم يزل يعطيني بـــلا حدود
أطال الله بقاءه، وألبسه ثوب الصحة والعافية، ومتعني ببره ورد جميله

إلى أخوتي وأخوأني
كنتم دائماً نعم العون لي

وإلى والدة زوجتي
التي دائما ما ضلت دعواتها تمنحني الأمل

اليـــكـ زوجتي الغالية
بكل الحب.. إلى رفيقة دربي
إلى من سارت معي نحو الحلم ..خطوة بخطوة
بذرناه معاً.. وحصدناه معاً وسنبقى معاً.. بإذن الله

وإلى هدية الرحمن أبنـائي
(عبدالإله و موضي و عبدالملك)
فأنتم زهور الحياة ونورها

D

Declarations

Following publications are all published.

Conference Papers

[C4] Al-Fawaz, K., Eldabi, T. (2012) ‘Extending IT Infrastructures in the Service Sector Organisations through Enterprise Resource Planning – A Telecom Case Study ’, *European Mediterranean & Middle Eastern Conference on Information Systems (EMCIS)*, Munich, Germany.

[C3] Al-Fawaz, K., Eldabi, T. and Kamal, M. (2011) ‘Investigating Factors Influencing The Decision Making Process For ERP Adoption And Implementation: An Exploratory Case Study’, *European Mediterranean & Middle Eastern Conference on Information Systems (EMCIS)*, Athens, Greece, pp. 141-153.

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[C1] Al-Fawaz, K., Al-Salti, Z. and Eldabi, T. (2008) ‘Critical Success Factors In ERP Implementation: A Review’, *European’, Mediterranean & Middle Eastern Conference on Information Systems (EMCIS)*, Dubai, UAE, pp. 1-9.

Doctoral Symposium

[DS 4] Al-Fawaz, K. (2011) ‘Evaluating the critical success factors in the implementation process of enterprise resource planning’, The 2nd Annual Symposium: Business School, Brunel University, Uxbridge, UK, 28th –29th March.

[DS 3] **Al-Fawaz, K.** (2010) 'Critical Success Factors for Enterprise Resource Planning (ERP) Adoption and Implementation from Different Perspectives', The 3rd Annual Symposium: Business School, Brunel University, Uxbridge, UK, 4th – 5th March.

[DS 2] **Al-Fawaz, K.**, (2009) 'An Investigation of the Factors That Impact Users Satisfaction in ERP Implementations', The 2nd Annual Symposium: Business School, Brunel University, Uxbridge, UK, 23rd–24th March.

[DS 1] **Al-Fawaz, K.**, (2008) 'Critical Success Factors in Enterprise Resource Planning Implementation: A Case Study in Saudi Arabia Hospital', The 1st Annual Symposium: Business School, Brunel University, Uxbridge, Middlesex, UK, 21st – 22nd May.

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Chapter One: Research Introduction

1.1 Introduction

Service Sector Organisations (SSOs) vary greatly with regards to what the organisations offer to their customers and the degree to which they function. For instance, large service organisations operate nationwide as well as globally, and deliver multiple services to their customers from one supplier e.g. offering online airline tickets (also termed as e-tickets). At the other end, there are Small and Medium sized Enterprises (SMEs) delivering specialist services locally, e.g. legal and consultancy. Increasingly, it is observed that new entrepreneurial style organisations are emerging in the recent years, specifically in the IT sector, which are rapidly developing and have international market access. Moreover, despite some similarities and sharing some characteristrics SSOs differ from manufacturing organisations with regards to tangibility of their output; production on demand or for inventory; consumer-explicit production; labor-demanding or computerised operations; and the necessity for a physical production locality (Uwizeyemungu and Raymond, 2011). Nevertheless, these SSOs face the challenge of delivering services effectively using affordable and scalable IT support (Ahmad *et al.,* 2007). For examples, where SSOs have abundantly adopted and implemented many IT/IS solutions and benefited from them (Stare *et al.,* 2006; De Búrca *et al.,* 2006); there are a plethora of IT project failures also reported (Khoumbati *et al.,* 2006; Ahmad *et al.,* 2007; Mantzana *et al.,* 2008). The latter two scenarios evidently highlight a lack of communal business-wide IT infrastructure within SSOs despite benefiting from their individual IT and IS solutions (Ozyilmaz and Berg, 2009; Uwizeyemungu and Raymond, 2011).

The downside of the assorted IT infrastructures in SSOs are scrutinised in detail in the literature (as part of Chapter Two), for example, excessive maintenance expenditures and customer data discrepancy and anomalies (Scott, 1999). SSOs including the healthcare and higher education institutions have also focused towards prevailing over their technological dilemmas by connecting their different applications (Khoumbati *et al.,* 2006; Ahmad *et al.,* 2007; Mantzana *et al.,* 2008). The core issue here is that SSOs adopted technological solutions that were not developed to interconnect with other existing applications (Khoumbati *et al.*, 2006; Ahmad *et al.*, 2007; Mantzana *et al.*, 2008). In this context, SSOs appear to have recognised that there a number of limitations in their technological infrastructure (as highly supported by Ahmad *et al.*, 2007) and that require appropriate approaches to enhance their effectiveness and offer improved services delivery (Ozyilmaz and Berg, 2009). The above discussed issues clearly indicate that in the existing dynamic business environment, rapid technological advancements, uncertain market environment and increasing customer expectations have necessitated the need for significantly improving business processes and organisational performance. To remain competitive in the business, SSOs need to focus on offering cost-effective solutions to customers, reduce total costs in the entire supply chain, lessen throughput times, increase their product options to customers, and certify enhanced customer service delivery with improved quality (Umble *et al.*, 2003; Stare *et al.*, 2006; De Búrca *et al.*, 2006; Ozyilmaz and Berg, 2009).

To realise these objectives, SSOs need to enhance their individual business practices and operational processes (Uwizeyemungu and Raymond, 2011). Nevertheless, this requisite has been achieved by the SSOs in adopting numerous technological solutions and automating their business processes and functions (Rajagopal, 2002; Irani *et al.*, 2005; Botta-Genoulaz and Millet, 2006). Over the last two decades, SSOs have focused on IT/ IS solutions to provide direct support to meet their customers' requirements, streamline their service delivery, optimise operations and manage complex service infrastructures that supports different group of stakeholders. These IT/IS (e.g. Enterprise Resource Planning (ERP) systems) and other business intelligent tools have offered several benefits to organisations and businesses. These benefits include: *(a)* support in collaborative decision-making, *(b)* reduced cost, *(c)* security and privacy of customers' data, *(d)* reduced operating costs and *(e)* flexible and maintainable IT infrastructures (Umble *et al.*, 2003; Nguyen, 2009; Poon and Yu, 2010). Such IT/IS led changes in the organisations have also paved the way for businesses to focus on Business Process Improvement (BPI), Business Process Restructuring (BPR), Total Quality Management (TQM) and more specifically ERP systems implementation (Hong and Kim, 2002).

According to Barney (1991), the Resource-Based View (RBV) of organisation supports this fact that resources are crucial for an organisation to achieve sustained competitive advantage – the *first* root of ERP is in the RBV of an organisation. The *second* usage of the ERP is control over costs, communication and information management which has its roots in the management control systems. Traditionally developed ERP has more internal utilisation; however, latest versions of ERP such as SAP R/3 or Enterprise One allow managers to map and monitor all stakeholder value management based on the thousands of different parameters. Hence, this root of ERP is in the management and control of IS (Laudon and Laudon, 2004). Data produced by ERP systems for managerial decision-making illustrates the performance of the organisation on many parameters. The most crucial parameters, however, are efficiency of the production operations and effectiveness of the management, to sustain the operational performance for profitability. Thus, performance management is directly addressed by ERP. Therefore, the *third* root of ERP is in the organisational performance management which is a component of Structure – Conduct – Performance (SCP) branch of the management (Umble *et al.,* 2003). These three closely related realms of management science define the context of ERP design and application.

1.2 Problem Definition

It is clear that ERP systems of today have evolved from Material Requirement Planning (MRPs) and MRPII systems. This evolution from MRP to ERP was due to several shortcomings on MRPII systems in managing a production facility's orders, production plans and inventories. Moreover, there was a need to integrate new techniques that led together to the development of a rather more integrated ERP solution (Chung and Snyder, 2000). Researchers report that ERP facilitates the automation of core business processes, and establishes links with stakeholders including suppliers, customers, business partners to integrate horizontal and vertical value chains of an organisation (Bajwa *et al.,* 2004). ERP systems are being developed constantly and nowadays they primarily include all integrated IS that can be used across any organisation (Kumar *et al.,* 2003). Despite the significance of ERP systems in organisations, adopting and implementing these systems is a complex exercise as the way organisations conduct their businesses is not standard (Markus and Tanis, 2000; Basoglu *et al.,* 2007). The high anticipation of accomplishing cost savings and service delivery improvements is highly reliant on how good the chosen ERP system fits to the organisational functionalities and how well the tailoring and configuration process of the system matches with the business culture, strategy and structure of the organisation (Al-Mashari *et al.,* 2006).

Literature indicates that two approaches are generally categorised in planning and designing the implementations of such systems, e.g. based on the appropriate fit between changes in system or organisation (Davenport 2000) and the strategy or opportunity (Themistocleous and Irani, 2002). However, it is also noted that the selection of approaches in introducing (i.e. adopting) and implementing new ERP systems to improve organisational performance in the developing countries has been a critical issue for SSOs (Al-Mashari *et al.,* 2003; Al-Mashari *et al.*, 2006). Such ERP systems are highly complex yet significant, nevertheless, simultaneously influencing the efficiency and efficacy of businesses – classifying them as highly complicated starting from adoption to implementation to realising their benefits (Remus, 2007). Researchers also argue that different ERP lifecycle phases require decision-making at every stage of internal integration and external collaboration; nevertheless, reasons for adoption, project team selection, resource allocation, can create hurdles in realising post-implementation benefits of ERP (Al-Mashari *et al.*, 2006). It can be inferred from this discussion that although ERP systems are complex, these systems primarily support the decision makers to strategically plan their organisational resources effectively. Thus, analysing such issues would provide more insights to understanding the adoption and implementation of ERP systems.

Furthermore, newer versions of SAP R/3 solution comprise of 5,000 different parameters which show the level of complexities involved with ERP. Adding to this, when client requires a tailor made ERP system for their organisation, it increases the time span whilst vendor and project team understand what is involved and what is required in designing the ERP (Scheer and Habermann, 2000). Such lack of resources and skills from the SSOs, its top management, project team or ERP vendor can cause failure in the adoption and implementation efforts. ERP systems have evolved as an expansion control or a remedial measure to improve the organisational performance. ERP systems have both strategic and tactical usage (Holland and Light, 1999); however, the major issue does not seem to be seeking the top management’s approval to invest in ERP but mainly it is in the design of adoption and implementation process. The investments of human and capital finances are not realised as implementation and post-implementation failure rates are as high as 70% (Al-Mashari, 2003; Nah *et al.*, 2007; Dezdar and Sulaiman, 2009). On the other hand, the high failure rates of ERP adoption and implementation cannot be attributed exclusively to the planning and design of technical components but lack of skills in managing change, project or large scale restructuring are also crucial factors (Muscatello and Chen, 2008).

Another major issue with ERP is an alignment between adoption objectives and utility sought by the organisation (Dawson and Owens, 2008). From the evolution, ERP has been used as a change agent, integrated system, business process tool, software, major project and a restructuring programme (Shang and Seddon 2000; Markus and Tanis 2000). This has led ERP to become multi-tasking system being integrated with improvement in every organisational aspect such as organisation structure, business process, management, communication, level, period, function and industry in itself (Jack, Kholeif, 2008). In the preceding years, employing a variety of ways to adopt and implement ERP systems has increased the ambiguity surrounding the input – output analysis of ERP phenomena. Exclusion of any such ambiguity is another ERP theoretical issue to be addressed. The major reason for this ambiguity can be attributed to plethora of ERP adoption objectives and approaches reported in the IS and specifically, ERP literature (Francoise *et al.,* 2009). In summarising the issues, the low successful implementation rate, lack of organisational capabilities to implement ERP systems, inappropriate designs and alignment with existing IT infrastructure, mismatches between utility and adoption objectives, and ambiguity in theoretical developments in the literature (Parr and Shanks, 2000; Levy *et al.,* 2001; Al-Mashari *et al.,* 2006; Bhagwat and Sharma, 2007).

1.3 Research Aim and Objectives

According to the abovementioned issues, merely going ahead and investing in ERP systems is not enough for solving the problems of any organisation and SSOs, in particular. This process requires a lot of effort e.g. understanding the critical success factors, different dimensions that lead to its adoption and implementation (Al-Mashari *et al.,* 2006). The author asserts that the research context can be reviewed by analysing various ERP adoption and implementation processes, the influential factors and lifecycle frameworks for ERP systems. Thus, in order to better understand the issues around ERP and its lifecycle phases and stages, SSOs may be benefited from a frame of reference to support their organisational goals. This frame of reference will provide with better assistance to SSOs to understand the effect of ERP adoption and implementation on their performance and structure, before proceeding with their investment strategy. The proposed frame of reference will be translated into a model that may assist the management in the SSOs in supporting effective decision-making for ERP investment. As a result, the aim of this thesis is to:

> "*Investigate enterprise resource planning adoption and implementation in the service sector organisations, resulting in the development of a model that may assist the service sector organisations in their decision-making process for ERP adoption and implementation.*"

Thus, based on the above aim, the objectives are outlined as below:

- ***Objective 1: To understand ERP adoption and implementation with relevant theories, models and frameworks with a particular focus on SSOs.***

The author defines the research problem that exists in the context of SSOs and ERP adoption and implementation. Thereafter, identify current gaps in achieving a solution for this problem.

- ***Objective 2: To investigate factors influencing ERP adoption and implementation in SSOs.***

  Understanding the critical success factors influencing the decision-making process for ERP adoption and implementation in SSOs may offer a profound comprehension on ERP adoption and implementation process. Hence, the proposed factors may be deemed necessary whilst ERP systems are initiated in SSOs.

- ***Objective 3: To investigate the importance of factors influencing the decision-making process for successful ERP adoption and implementation in SSOs.***

  The author recommends that it is vital to study the prioritisation of factors influencing ERP adoption and implementation in SSOs to support the decision-making process in SSOs to adopt appropriate ERP solutions.

- ***Objective 4: To investigate different lifecycle phases and stages comprising of relevant activities of ERP adoption and implementation.***

  The SSOs can pass through several adoption and implementation lifecycle phases and stages while adopting and implementing ERP systems. Therfore, The author has divided lifecycle into phases as external layers and stages within each phase as more intricate elements. This removes the ambiguity of phases and stages and would be more helpful.

- ***Objective 5: To investigate the mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages.***

  The influential factors for ERP adoption and implementation can be mapped on different lifecycle phases and stages to support the decision makers while adopting and implementing ERP systems.

- ***Objective 6: To develop and propose a model for ERP adoption and implementation in SSOs.***

  Based on identifying ERP critical success factors, prioritisation of factors, lifecycle phases and stages and mapping of factors across the ERP lifecycle stages, the author will offer an integrative model. This model may improve the level of analysis and support SSO decision makers when adopting and implementation ERP.

- ***Objective 7: To develop a research plan for assessing and evaluating ERP adoption and implementation model for SSOs.***

  The author will develop a research plan in order to assess and evaluate the feasibility of the proposed conceptual model.

- ***Objective 8: To assess and evaluate the model, within practical arena and provide a novel contribution to the domain of SSOs and ERP.***

  After developing the conceptual model, the author will assess and evaluate the feasibility of the this model through conducting case studies to find out if there are (1) other factors influencing the ERP adoption and implementation in SSOs and (2) other ERP adoption and implementation lifecycle phases and stages.

1.4 Research Methodology

Thus, based on the above the research objectives, the proposed methodologies are outlined as below to achieve these objectives.

1. To achieve the first objective, this objective will be met by collecting, synthesising, analysing and inferring the findings of existing academic and industry literature. To increase the reliability and validity of such a review, the author proposes to collect it from authentic sources such as refereed journal and from multiple sources like using many databases with different set of key words to search the material.

2. To achieve the second objective, the literature gathered on ERP adoption and implementation including factors influencing ERP will be categorised first according to each researcher defining the ERP category and CSFs applied by each researcher. The next activity is to extract each CSF from the ERP literature and measure the

frequency of each CSF appearing in the literature. Then, each factor will be assessed for its impacts on the ERP adoption and implementation process.

3. To achieve the third objective, this objective focuses on investigating the importance of critical success factors by using the Analytical Hierarchy Process (AHP) technique. This technique will be used to evaluate the priority of each CSF over the other CSF in a specific factor category.

4. To achieve the fourth objective, ERP activities can be reviewed as a theory building process from whole to part that is overall lifecycle to be divided in small set of activities in each stage and from part to whole that is all activities. The author will differentiate between lifecycle phases and stages of the ERP adoption and implementation process. This will also support the extraction and mapping of the CSFs for each lifecycle phases and stages.

5. To achieve the fifth objective, this objective focuses on mapping of factors on different stages of the lifecycle. This will be carried out after conducting empirical research as part of Chapter Five.

6. To achieve the sixthth objective, a conceptual model will be developed based on four steps: *(a)* identification factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* identification ERP adoption and implementation lifecycle phases and stages, and (d) mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages. This objective will assess the proposed conceptual model from the case study evidence. The case study evidence will be in the form of analyses of secondary and primary data from the selected case studies in the SSOs.

7. To achieve the seventh objective, the author will prepare a research plan which will eventually lead to the assessment and evaluation of the proposed conceptual model. The research plan begins with developing a methodological frame to build the research design. This plan will support in achieving the research work presented in this thesis.

8. To achieve the eighth objective, considering the findings of case study evidence and assessment of proposed conceptual model, the author will further modify and finally, present a conceptual model for ERP adoption and implementation in SSOs. The model is inductively derived based on the findings from academic and ERP practice data from literature and case studies. Hence, the model may support to bridge the

divide between theory and practice of ERP and in turn, support the managerial decision-making.

1.5 Thesis Outline

This section provides the outline of the remaining chapters of this thesis. This thesis follows Phillips and Pugh (2000) who described methodology of four elements:

- Background Theory
- Focal Theory
- Data Theory
- Novel Contribution

Background theory provides to introduce the research context (Chapter One), critically analyses the literature and identify the research issues (Chapter Two). Chapter Three aims to focus on the focal theory for this thesis and develop and propose a conceptual model. In addition, data theory (Chapter Four and Chapter Five) Chapter Four describes the research methodology adopted where as Chapter Five implements the research plan by collecting data, analysing the findings generated from the results obtained from data interpretation. The novel contribution (Chapters Six and Chapter Seven) Chapter Six aims to propose the revised conceptual model based on the empirical findings. Final, Chapter Seven describes the research summary, main contribution, research limitations, and set of recommendations for the industry managers and practitioners, and further research scope emanating from this thesis.

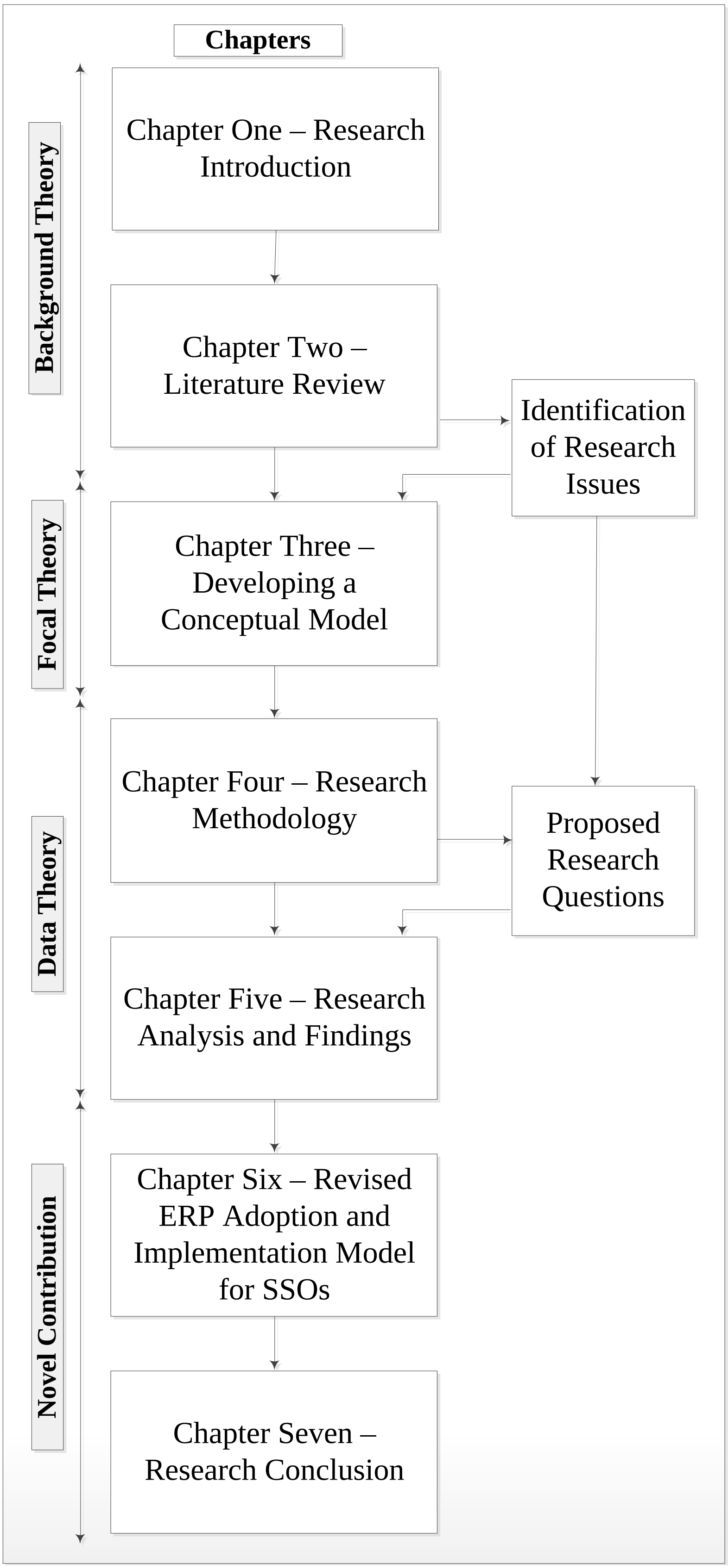

Figure 1.1: Thesis Outline

- **Chapter One: Research Introduction**

  This chapter starts by presenting an introduction to the main issues and research problem that exists in the context of SSOs and ERP domain. These issues consider the need to understand ERP adoption and implementation practices and improve the decision-making process in SSOs. It also has provided the main aim and objective of research as a foundation to build this thesis.

- **Chapter Two: Literature Review**

  This chapter starts to review the literature on IT adoption and implementation practices in SSOs, highlights several IT infrastructure limitations in SSOs, emphasize the need for improving SSO IT infrastructures, analyses ERP literature and explains the benefits realisation, challenges and ERP failure. Then, the author discusses ERP adoption and implementation, factors for ERP adoption and implementation and ERP adoption and implementation lifecycle phases. Lastly, justifying the need for a collective and systematic approach for adopting and implementing ERP in SSOs.

- **Chapter Three: Developing a Conceptual Model**

  This chapter proposes: *(a)* the identification of factors, *(b)* prioritising the importance of factors that may provide a deeper understanding of such interrelationships within SSOs, *(c)* the identification of ERP adoption and implementation lifecycle phases and stages, and *(d)* the mapping of factors on ERP adoption and implementation lifecycle phases and stages. In addition, this chapter proposes a conceptual model for ERP adoption and implementation in SSOs. The proposed model is developed to support management when taking decisions regarding ERP adoption and implementation.

- **Chapter Four: Research Methodology**

  This chapter aims to prepare a research plan which will eventually lead to the assessment and evaluation of the proposed conceptual model as described in the Chapter Three. In this chapter also, the author describes the justification for selecting an appropriate research methodology. This chapter describes the research methodology adopted that will support in achieving the research work presented in this thesis.

- **Chapter Five: Research Analysis and Findings**

  This chapter analysed and presented case studies that were conducted in two KSA service sector. The results of secondary and primary data collected provide major findings and discussion of: *(a)* background to case studies, *(b)* ERP project process, *(c)* state of ERP, and *(d)* assessing the research propositions.

- **Chapter Six: Revised Conceptual Model**

  This chapter exemplifies revised ERP adoption and implementation factors and revised ERP adoption and implementation lifecycle phases and stages based on case studies findings. It will suggest modifications to revise the conceptual model for ERP adoption and implementation.

- **Chapter Seven: Research Conclusion**

  This chapter outlines the research overview employed in this thesis. It discusses on the main contributions of this thesis. Then, this chapter moves onto highlighting the research limitation that requires further attention. Lastly, based on the overall research conducted in this thesis, the author presents some key recommendations.

1.6 Conclusion

From the research synopsis presented in this chapter, the author argues that adopting and implementing ERP systems is a huge task for organisations. The decision makers in SSOs are thus required to prioritise their technological infrastructure planning and deployment in order to fully realise their initiatives. Such infrastructure ought to be flexible, scalable, and facilitate interoperability within and across SSOs. This chapter discussed on the research context and the problem domain, research aim and objectives, and overall structure of this thesis.

2

Chapter Two: Literature Review

2.1 Introduction

As reported in Chapter One, researchers have shown limited interest in ERP adoption and implementation in the SSOs. Literature suggests that the conceptual (including theoretical) and pragmatic findings derived from the study of ERP adoption and implementation in other sectors (and in general) may provide greater understanding of the phenomenon of ERP. However, they cannot be generalised or applied to SSOs without testing and valid justification. Among others this may be attributed to: *(a)* nature of working, *(b)* structure and type of SSO, *(c)* characteristics of a specific SSO, *(d)* operational and functional activities and *(e)* decision-making process that may differ from other sector organisations.

2.1.1 Chapter Objectives

In an attempt to study ERP adoption and implementation in the SSOs (hereafter SSOs can be related to any organisations from manufacturing, higher education, banking, healthcare, public agencies, telecommunication, and airline industry), the purpose of Chapter Two is to critically analyses the literature and identify the research issues that exists in the context of SSOs and ERP domain.

2.1.2 Chapter Structure

This chapter starts by reviewing the literature on IT adoption and implementation practices in the context of SSOs in Section 2.2. Subsequently, In Sections 2.3, the author assesses the literature on SSO IT infrastructure and therefore, highlights several IT infrastructure limitations within SSOs. Next, Section 2.3.2 highlights the need for improving SSO IT infrastructures by deploying integrated systems such as ERP systems. Section 2.4 starts by analysing ERP literature and explains the benefits realisation (Section 2.4.1), challenges (Section 2.4.2) and ERP failure (Section 2.4.3). The purpose of whole Section 2.4 is to justify the need that ERP systems are required in the context of SSOs, in order to improve their operational and functional practices and overcome their existing technical and organisational issues. Thereafter, in Section 2.5, the author discusses on ERP adoption and implementation. Moving onto Section 2.5.1, the author discusses on factors for ERP adoption and implementation, whereas, in Section 2.5.2, the author discusses on ERP adoption and implementation lifecycle phases (i.e. pre-implementation; implementation and post-implementation). Lastly, in Section 2.5.3, the author justified the need for a collective and systematic approach to adopting and implementing ERP in SSOs (i.e. systematic approach focusing on factors, prioritisation of factors, ERP lifecycle phases and stages and mapping on factors) and highlighting the research issues for further investigation while summarising the conclusions in Section 2.6.

2.2 Information Technology Adoption and Implementation in SSOs

Service sector organisations have long been considered as the prime engine of regional, nationwide or international economies, and therefore has acquired the most consideration from practitioners and academics including public and government organisations (Ozyilmaz and Berg, 2009; Uwizeyemungu and Raymond, 2011). However, it is highly acknowledged that a critical stipulation for SSOs is the need to determine capabilities to administer their portfolio of resources, including information technologies, as core services for business processes (Rai and Sambamurthy, 2006). The function of IT is, in particular significant, as these technologies have rapidly become one of the most important infrastructural elements of SSOs (Ozyilmaz and Berg, 2009). Essentially, some advocates have gone as far as to state that SSOs will also require to implement 'e-processes' in form or the other in order to survive in the current competitive marketplace (Tsikriktsis et al., 2004). Over the last few decades, IT has emerged as a strategic resource for SSOs and other business organisations, which have enabled them to enhance their business processes, reform their operational activities and achieve varying degrees of success (Okunoye et al., 2007). The latter argument is supported by Pilat and Devlin (2004), who state that SSOs are considered one of the most ardent users of information technology and different information systems.

The transformation from conventional way of functioning to becoming more technology savvy due to the global competitive environment, has forced many organisations to continue their endeavours in adopting and implementing the state-of-the-art technological solutions (Tsikriktsis et al., 2004; Ozyilmaz and Berg, 2009). This is evident from the fact that from the mid to end of 1990s, SSOs exceedingly focused on investing substantial amounts of capital to adopt new technological solutions (Scott, 1999). The extant ample research conducted on IT discipline to-date barely needs any rationalisation with regards to SSOs. This is because the academic scholars, practitioners, policy makers, business executives, and even public managers highly endorse the fact that IT is a prime basis of economic development, industrial transformation, and competitiveness. Following the latter conceptions, organisations have adopted and implemented modern IT solutions in response to the rapid changes in IT discipline, increasing customers' expectation, and organisational managements' ambition to accomplish distinguishing capabilities and enhance their overall operational performance. As researchers study SSOs, it is evident that technologies and management of technologies play a significant role in reforming these organisations (Spohrer and Riecken, 2006).

In quantifying the IT intensity in SSOs, the share of investments in total organisational investments clearly highlights the lead role of SSOs in the marketplace (Uwizeyemungu and Raymond, 2011). Other advocates such as Stare et al., (2006) exemplify that for SSOs, the average share of IT investments in total organisational investment is nearly 35 percent. According to Mulligan's (2002) research, in United States the SSOs invest yearly over US$ 100 billion in IT, however, from this 100$ billion the service sector's rate of collective rights of the installed IT solutions is estimated to be around 85%. Stare et al., (2006) argues here that the dominance of service sector in the marketplace can be attributed to the fact that a plethora of services are much more information- rigorous in nature, needing additional processing and dissemination of information than other sector organisations. The latter argument is supported by De Búrca et al., (2006), who describe that 'information intensive work activities in terms of service practices necessitate highly sensitive IT systems so as to facilitate enhanced service level performance'. According to another study, even during the times of economic recession, IT expenses in the SSOs continue to nurture (IDC, 2009). Regardless of the huge usage and success of IT in SSOs, Uwizeyemungu and Raymond (2011) argue that the substantial adoption of IT by SSOs must be further scrutinised, as distinguished differences may remain hidden.

Despite the increasing up-take of different IT solutions in SSOs, many organisations are still reluctant in adopting new IT and some also perceive that IT does not count as a strategic resource due to its commoditisation. IT although provides tactical and operational advantages to organisations, nevertheless, technology adoption issues may impede IT advantages. On the other hand, IT vendors are required to apply diverse product demarcation strategies to gratify distinctive customer segments. Acceptance, utility, and usability of system designs have become a focal interest in service design and development, yet at present there is a lack a detailed understanding of technology adoption aspects. Thus, organisations need to focus on developing adaptive and usable systems to overcome technology adoption problems and enabling them to derive benefits from IT (Seneler et al., 2010).

Moreover, from the healthcare organisation perspective (an example of a service providing organisation), substantial amounts of investments and countless working hours have been designated on modernising the healthcare sector. However, most of the healthcare related IT/IS projects have failed to fulfill their potential (Khoumbati et al., 2006; Mantzana et al., 2008). For example, lists of high profile major projects' failures, globally, emerge to support these latter arguments (Heeks, 2006). Hospitals are among those service organisations where delays and cancellations of software projects and diffusion to use healthcare related IT/IS are common (Khoumbati et al., 2006; Mantzana et al., 2008). Moreover, the lack of education and training among others may be as a major impediment in the successful adoption of IS in these SSOs. Literature indicates that to augment IT adoption and sustaining a professional relevance, it is crucial to service organisation workforce undergo a process of constant training – also referred to as work-related learning. Nevertheless, in a number of such SSOs, when implementing IT/IS projects, they do not contemplate the direct and indirect cost of training and do not train their employees on IT/IS (Khoumbati et al., 2006; Mantzana et al., 2008). This is primarily due to the lack of appropriate support on IT/IS training, the expenditure of training provision and the deficiency in productivity and efficiency when workforce are not available for training purposes. The extant literature also highlights that SSOs face difficulty in developing and implementing IT/IS related training programs for their workforces (Khoumbati et al., 2006; Mantzana et al., 2008).

Another example of SSOs is higher-education institutions that have invested large amounts of capital in technological solutions to support their decision-making processes and offer seamless services to their students and communities, in general. Ahmad *et al.,* (2007), reports that IT deployments can be essentially indeterminate, and implementing technology solutions has been notoriously challenging and problematical. According to Seneler *et al.*, (2010) the airline service sector has also focused on adopting highly sophisticated systems to move towards online service provision such as reservation, e-ticketing, diet or seat selection, online or kiosk check-in services – which reduce the travelling burden from the customers. Although, all the modernisation efforts undertaken in the SSOs (as aforementioned) have assisted the managements in developing better understanding towards IT/IS solutions, however, these organisations have also resulted in developing a mass IT/IS solutions that require integration with other applications (Spohrer and Riecken, 2006). Integration of these applications within services sector organisations is one of the most urgent priorities to meet the increasing organisational and management needs (Ahmad *et al.,* 2007).

Literature highlights that while SSOs have adopted several IT applications to overcome their organisational and managerial issues and improve their operations and functions, the concerns of providing quality and seamless services, IT infrastructure automation, and integration problems still persist. To comply with customer and other stakeholder requirements and harness the full potential of IT/IS solutions to transform their transactions with service users and consumers, SSOs have to: *(a)* streamline their IT infrastructures, *(b)* embark on structural and operational transformations to accommodate varying consumer needs, (c) enhance decision-making process while adopting technological solutions, *(d)* maintain consistency and quality of information across all interaction channels of the organisation and *(e)* follow an efficient methodical process while adopting technological solutions. The latter are some of the vital issues faced while adopting and implementing ITand SSO managements need to perform due diligence during the process to maintain against technological project failures. The issues as discussed earlier mainly emphasize on the technical problems in SSO IT infrastructures. Section 2.3, presents other additional limitations in SSOs.

2.3 IT Infrastructure Limitations in SSOs

Literature highly acknowledges that SSOs (i.e. service provision organisations from different sectors) have largely implemented numerous technological solutions and benefited from them (Stare *et al.,* 2006; De Búrca *et al.,* 2006). At the same time, there is a plethora of case where IT project have failed to fulfil the anticipated aspirations of the managements (Khoumbati *et al.,* 2006; Ahmad *et al.,* 2007; Mantzana *et al.,* 2008). Issues highlighted in Section 2.2 are further extended in this section, leading to presenting taxonomy of IT infrastructure limitations in the context of SSOs:

- **Information Systems Implementation Failure Issues:** Literature evidently underscores a considerable body of testimony that in the past, where there were successful information systems successes, a number of information systems implementation projects have also ended in failure (Pan *et al.,* 2008). The latter argument is supported by Moohebat *et al.,* (2010), who exemplify that although IT is indivisible component of any organisation but it has also had some intense effects on a number of organisations (Pan *et al.,* 2008). Researchers report on the failure rates for some of the most important information systems projects appears to be around 70% (e.g. Drummond, 2005). Some advocates also accredit this upsetting rate of failure to the increasing intricacy of their existing legacy information systems, whereas, other relate the failures to multiplicity of factors, e.g. impractical anticipations, deficiency in a number of key resources, technical aspects, inflexible clients, and most vitally, frail administration of service providers (Fitzgerald and

Russo, 2005). The phantom of failure has haunted a number of organisations as they continue to invest valuable resources but do not achieve their original functional objectives.

The abovementioned issue on 'IS implementation failures' clearly indicates that there is a need for SSOs to focus on developing enterprise-wide integrated systems that result in enhanced business processes and end-to-end service delivery.

- **Information Sharing and Integration Issues:** Several academics have clarified that to gain the maximum benefits of using ICTs to enhance organisational business processes, organisations within the service sector are required to integrate and share their information (Bigdeli *et al.,* 2011). Other researchers accentuate that information sharing supports organisations to fulfil their customers' ever-changing requirements, engender solutions to acquire competitive edge in the marketplace, lead to enhanced customer contentment, and product and service quality and profitability (Dawes, 1996; Akbulut *et al.,* 2009). The latter arguments are supported by Barker (2008), who highlight that information sharing is most certainly one of the leading factors having an effect on organisational effectiveness, efficiency and performance. However, Bigdeli *et al.,* (2011) argue that there are a number of cases on information integration and sharing development projects have failed to deliver the anticipated benefits, as a large percentage of these failures are due to social and organisational factors, rather than just technical issues. A considerable problem that system developers are confronted with is that the organisational effects ensuing from the implementation of an information system are adverse and impulsive (Doherty and King, 2005). Given that, sophisticated and intricate IS can interrelate with the host organisation in diverse ways, it would be indeed by complicated to envisage all of their impacts (Gil-Garcia *et al.,* 2007; Bigdeli *et al.,* 2011).

  The abovementioned issue on 'Information sharing and integration' clearly signify the importance of this area that there is a need for SSOs to invest a number of resources, such as capital and workforce time, in order to develop such enterprise-wide integrated system that facilitates seamless flow of information.

- **Data and Information Security and Privacy Issues:** Organisations always pursue for a well-established and secure environment with coherent enterprise systems to operate according to their needs and requirements. According to Mwakalinga and Yngström (2004), security and privacy concerns are vital whilst providing electronic services to customers. For example, security breach is one of the many everyday issues in SSOs (Al-Ameen, 2010). That is, a security breach event when occurs, a specific susceptibility (e.g. customer or staff information) is exploited to undermine or avoid tight security procedures. In such an open and distributed processing environment, access control and authentication mechanism is very critical for SSOs. Incidents of such nature often result in significant amounts of interruption and financial loss to the organisation. Thus, a significant impediment in implementing enterprise systems that also offer online facilities is the customers' and employees' worry on privacy of their confidentiality of the personal data they are providing as part of obtaining services (Al-Ameen, 2010). The latter argument is supported by Kamal *et al.*, (2008), who state that service providing organisations need to offer robust technological solutions and transparency of mechanisms.

The abovementioned issue on 'Data and Information Security and Privacy' evidently indicate the importance of this area that there is a need for SSOs to invest in such an enterprise-wide integrated system that facilitates the process of safeguarding customers and employees' data and information.

- **Business Process Reengineering Issues:** In today's global competitive environment, organisations are continually in pursuit of creative methods to subsist and outperform their competitors. Literature indicates that management approaches such as the business process re-engineering are widely adopted by a number of SSOs with the aim to accomplish tremendous and significant increase in performance and expenditure cutbacks. It is reported that business process re-engineering is the essential re-thinking and thorough revamp of business processes to accomplish enormous enhancements in vital modern measures of performance (e.g. cost, quality, service). However, the increasing focus on designing business around process has caused a significant paradigm shift in the way information systems are implemented and utilised to support business operations (Tapscott and Catson, 1993). Unless organisational IT infrastructures are not developed to match the scope of cross-functional chains of business processes, they would turn to be the greatest challenge in realising a truly process-oriented business. Al-Mashari (2001) highlight that as the perils involved and failure rates related with business process re-engineering projects are excessive, it is vital to further explore the failure rationales utilising a methodical approach.

The abovementioned issue on 'Business Process Re-engineering' manifestly point towards the need for SSOs to focus on implementing enterprise-wide information systems that vitally work towards incorporating prime operational systems within the organisation.

- **Front-Office/Back-Office Operational Issues:** SSOs have designed and implemented a number of information systems to enhance their operations and service provision to customers (Tsikriktsis *et al.,* 2004; Okunoye *et al.,* 2007). However, one of the prime distinctive aspects of delivering services is the amount of customer contact as part of the whole service delivery system (Nie and Kellogg, 1999). It is observed that for a number of services, the presence of customer is vital for interacting or participating in the service delivery system. Safizadeh *et al.,* (2003) adds on to the latter argument that customer contact establishes reservations and disparities in the service delivery system and stresses for the need for changes in the overall design of the system – i.e. from front-office to the back-office. The combination of front-office and back-office operations can also be a practicable strategy. However, in the context of service system design in SSOs, Hill *et al.,* (2002) and Boyer and Lewis (2002) assert that for front-office and back-office operational issues there is a need for further attention. For example, there is a need for seamless and single point of contact for customers having in mind that their requirements keep changing (Voss, 2003). The latter is possible by structuring front-office and back-office operations in service delivery.

  The abovementioned issue on 'Front-Office/Back-Office Operations' clearly suggest the need for SSOs to focus on implementing enterprise-wide information systems that essentially synchronise IT infrastructure operations from front-office to back-office and vice versa.

- **Economic Issues in Implementing Integrated Information Systems:** Organisations from any sector always intend and attempt to lessen their expenditures in order to enhance their financial capacity (Moohebat *et al.,* 2010). The latter argument is supported by Kalakota and Robinson (2001), who advocate that non-integrated IT infrastructures have recurrently resulted in organisations losing product sales, lower service quality and this enforces a negative effect on the organisation internally and externally. The SSOs, thus, need to focus on decreasing the expenditures of running and maintaining IT infrastructure that comprises of a heap of non-integrated systems and as a result, reduce the redundancy/ discrepancies of information and systems (Khoumbati *et al.*, 2006; Mantzana *et al.*, 2008). Researchers such as Light and Papazafeiropoulou (2004) claim that ERP systems are integrated systems that support in eradicating information redundancies and inconsistencies and enhance coordination among other systems in the infrastructure.

The abovementioned issue on 'Implementing integrated information systems' clearly suggest the need for SSOs to focus on implementing enterprise-wide information systems that will essentially improve the overall efficiency and performance of SSOs.

- **Facilitating Management's Decision-Making Process:** Researchers such as (Holsapple and Sena, 2003) highlight that the necessity to support managements in their decision-making process with synchronised data stipulates the implementation of IT infrastructure that incorporates integrated systems. On the other hand, the limitations in SSO IT infrastructures restrain the implementers and management to take precise decisions (Ahmad *et al.*, 2007). The rationales for this are: information systems diversity, existing information contradiction and inconsistencies, reduced information quality and, deficiency of harmonised customer view. For example, SSOs implemented a number of disparate applications that were not compatible with each other. This resulted in applications storing customer and employee data for the same entity several times. This further resulted in incapability to bring together data from different systems and take decisions accordingly given that there is data inappropriateness, perplexity regarding data quality, interaction issues (e.g. one applications cannot interact and exchange data with other application due to their development features), interdepartmental harmonisation therefore, impinging on the success of SSOs.

  The abovementioned issue on 'Facilitating Management's Decision-Making Process' noticeably suggest the need for SSOs to focus on implementing enterprise-wide IS that will essentially improve the overall decision-making process of managements.

SSOs, as these are service providing organisations with different nature, management structures, technical infrastructure needs and operational activities (e.g. airline, telecom, healthcare, local government, education, etc) – all have a number of discrete business processes that necessitate discrete information transformations and process control formation. As a result, SSOs are required to overcome the abovementioned IT infrastructure limitations by inter-connecting different legacy and existing systems based in different departments such as human resource, finance and accounting, procurement, etc. In doing so, this will enhance the management's decision-making process. In the following section, the author presents the need for Enterprise Resource Planning systems that may assist the SSOs in prevailing over their existing IT infrastructure problems.

2.3.1 The Need for ERP

Based on the assessment of the IT infrastructure limitations, it is clearly evident that a conventional organisation's existing or legacy information systems are essentially oriented on a day-to-day functional basis. In the supporting the latter argument, Chang *et al.,* (2008) points out that this type of IT infrastructure system does not facilitate efficient organisational and departmental interaction and communication within the organisation. The rationale is that conventional or legacy information systems do not fulfil the global logistics' information needs. This indicates that SSOs require an integrated IS solution to overcome their IT infrastructure limitations. Lately, there has been high emphasis on organisations to upgrade their IT infrastructures by integrating internal and external operational activities in order to enhance competitiveness in the global marketplace (Esteves, 2009). Chang *et al.,* (2008) argue that this approach when applied to develop an integrated IT infrastructure has developed into a foremost driving force. Such a need for developing integrated IT infrastructures may also be attributed to several technological projects that were either never implemented or abandoned immediately after implementation and due to this many problems such as data integration or security interoperability that are technical in nature, remain most apparent at developmental and functional levels (Liu and Seddon, 2009).

In the context of SSOs, several efforts have been made to overcome the technological limitations at various levels e.g. adopting and implementing system (e.g. see Siguaw *et al.*, 2000; Beor and Mandal, 2000; Barnhart *et al.*, 2003). The analysis of these information systems (e.g. whether related to healthcare, local government, higher education) underline that they have their individual sets of parameters and functions and each of them diverge from the other since their design is not focused on corresponding strictures. Advocates argue that although these information systems have provided significant benefits, they have not resulted in the development of an integrated IT infrastructure that efficiently automates business processes and services (Chang *et al.*, 2008). The reasons may be that they were developed according to specific requirements and solving certain problems. It can be argued that projects developed for a specific area and solving particular problems may not comply with the integration needs in different areas and cultures.

Although the adopted and implemented information systems have not supported SSOs in achieving the level of integrated technological infrastructure needed, they have nonetheless contributed to better understand the limitations of SSOs IT infrastructures issues. Due to the IT infrastructure limitations reported earlier, SSOs are constrained and face difficulties to overcome their organisational and IT infrastructure limitations, quality of service provision, and enhance their performance and productivity. Literature also indicates that SSOs are increasingly challenged to respond more flexibly to issues confronting customers (Khoumbati *et al.*, 2006; Ahmad *et al.*, 2007; Mantzana *et al.*, 2008). As a result, the author argues that there is a need for an enterprise wide integrated information system that attempts to meet SSOs' organisational requirements and infrastructure limitations. The latter argument is supported by Allen and Kern (2001), who emphasize that there have been several calls from the governments across the world for SSOs (including higher education institutions) to enhance their operational efficiencies and to reduce duplication of resources by implementing enterprise-wide integrated information systems that span the SSO and enhance their processes. Evidently, the limitations discussed in the earlier sections; indicate the need for the adopting and implementing of ERP systems in SSOs. To provide a philosophical understanding on ERP and its significance in SSOs, the following section critically reviews the extant literature on ERP.

2.4 Enterprise Resource Planning

Enterprise resource planning systems have emerged to support and automate business processes and redefine the potential of enterprises, regardless of their size and industry (Wei and Wang, 2004; Chand *et al.*, 2005; Esteves, 2009). In the early 1990s, many business organisations began to realise the significance and need for a shared organisation-wide platform for interaction, communication and integration between business divisions (Allen and Kern, 2001; Wagner and Newell, 2006). However, based on the Material Requirement Planning (MRP) and Manufacturing Resource Planning (MRP II) systems, ERP systems superseding the latter two systems, surfaced as one of the foremost vital developments in the corporate use of IT (Al-Mashari *et al.*, 2003; Somers and Nelson, 2004; Perera and Costa 2008). Literature highlights a number of definitions on ERP, for example, following definitions are reported to exemplify ERP comprehensively:

- *ERP comprises of a commercial software package that promises the seamless integration of all the information flowing through the company – financial, accounting, HR, supply chain and customer information* (Davenport, 1998).

- *ERP now considered as a price of industry entry is an enterprise wide resource planning system which comprises set of software to manage and to integrate all business functions within an organisation* (Shehab *et al.*, 2004).

- *ERP software is a suite of application modules that can link back-office operations to front office operations as well as internal and external supply chains. It conjoins functional areas and business processes in an integrated environment that provides a broad scope of applicability for organisations* (Verville *et al.*, 2005).

- *ERP systems have emerged as an enabling technology which integrates various functional (operations, marketing, finance) IS into a seamless suite of business applications across the company and thereby, allowed for streamlined processing of business data and cross-functional integration* (Gupta and Kohli, 2006).

- *ERP systems are configurable information system packages that integrate several business functions* (Wu and Wang, 2006).

- *The ERP is generic term for a broad set of activities supported by multi-module application software that helps organisations to manage their resources. The ERP system has been able to provide significant improvement in efficiency, productivity and service quality, and lead to a reduction in service costs as well as to more effective decision making* (Ngai *et al.*, 2008).

- *ERP systems are integrated and corporate-wide systems that automate core activities such as manufacturing, human resources, finance and supply chain management. In such systems the fragmented information is integrated to support the decision making process* (Razmi *et al.*, 2009).

Despite the abovementioned and other definitions on ERP theorised in the literature, Marnewick and Labuschagne (2005) argue that several researchers still battle to comprehend the factual essence of ERP. According to Marnewick and Labuschagne (2005), ERP is: *"a packaged business software system that lets an organisation automate and integrate the majority of its business processes, share common data and practices across the enterprise and produce and access information in a real-time environment. The ultimate goal of an ERP system is that information must only be entered once"*. The author argues that this latter definition even further thoroughly summarises the essence of ERP indicating that ERP systems are more than just a product or software that facilitates and fulfills the requirements of an organisation. Figure 2.1 exemplifies the differences in the number of connections when traditional integration approaches are applied with those of enterprise resource planning based infrastructure.

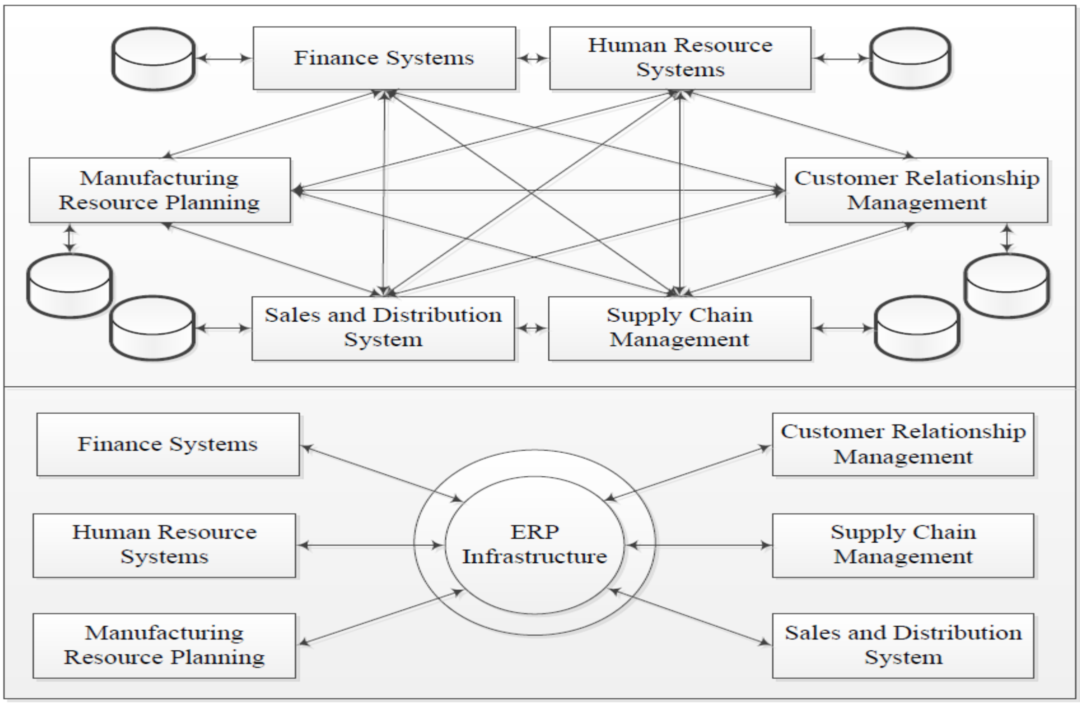

Figure 2.1: Conventional IT Infrastructure Approaches v/s ERP based Infrastructure

In analysing the above definitions on ERP, it can be deduced that ERP has shifted from being denoted as a software tool to managing data and evolved into an integrated system – an organisation-wide business process application that can bring significant changes and improvement at all levels in the organisation (Gupta and Kohli, 2006). Advocates such as Razmi *et al.,* (2009) accentuate that these systems provide an attractive solution to practicing industry executives to eradicate mismatched systems and incoherent strategies. Nah *et al.*, (2001) and Kemp and Low (2008) support the latter argument and state that ERP systems' procurement and implementation largely increases organisational productivity and overall operations quality, since the system provides standardisation and generalisation in manifold, complex operational procedures across the organisation. This indicates that information can effortlessly be shared, relocated and exchanged amid different users across different business divisions in the organisation. The latter argument is supported by Doom *et al.*, (2010), who highlights that in enhancing IT infrastructure through ERP systems can facilitate and manage communication and coordination among separate business division. Marnewick and Labuschagne (2005) also reports that a number of organisations realise the potential and capacity of ERP systems, yet still struggle to materialise the factual benefits. This leads to being inquisitive about the pragmatic essence of ERP systems. The author takes into consideration this inquest and further critically analysis the ERP domain (with regards to ERP benefits realised, challenges confronted and ERP failure) in the subsequent section.

2.4.1 ERP Systems: Benefits Realisation

ERP systems play a significant role in business organisations, however, in order to realise this, individuals in the organisations are required to have an overall understanding of the key features of ERP to function well in any organisational setup. ERP systems capitalise on computer technology and facilitate business organisations to have detailed perspectives into a wide range of organisations' operational activities, enabling them to share information seamlessly amid organisations, departments and personnel for better management. ERP systems are highly considered as extensive, integrated software systems that support IT infrastructure, business process and other internal operations of an organisation (Doom *et al.*, 2010). These systems have become a sought-after tool for multi-purpose improvement of organisational functions, its processes and final performance (Ross and Vitale, 2000). Rationale to adopt ERP systems have primarily been the substantial benefits that the organisations aspire to acquire, or insubstantial viewpoint to fortify the organisation's business structure (Nguyen, 2009). There are several internal conditions within an organisation and along with its core and non-core resources that play an equivalent part as compared to the competitive forces of the business environment (Boonstra, 2006).

ERP adoption and implementation is not merely confined to one department but is an organisation wide issue and can be perceived as a modernisation and automation project, strategic change, an organisational system, software, business process improvement technique, or an IT integration of the firm (Macpherson *et al.*, 2003). These different categories exemplify different perspectives of employing ERP systems within an organisational setup, such as: stakeholders, business processes, technology and IT infrastructure, organisation and project. ERP systems offer both types of benefits to organisations i.e. tangible and intangible.

- From tangible perspective, ERP systems can directly affect the bottom line of the business and from intangible perspective; ERP systems are less quantifiable and less measurable as an actual value (Poon and Yu, 2010).

- For instance, cost reduction and increase in operational efficiencies can be regarded as a tangible benefit (Mathrani and Viehland, 2010), whereas improved customer services by more happy faces in a retail store is intangible (Remenyi *et al.,* 2000).

- Murphy and Simson (2002) deduce from Remenyi *et al.,* (2000) that tangible and tentative benefits can have high and low degrees of being directly effectual.

- Irani and Love (2001) add to the latter that corporate level strategic benefits might be generally intangible and non-quantitative whereas tactical and operational benefits are in general, tangible and quantitative in nature.

- Nguyen (2009) also reports here that intangible benefits can be either on-going or be realised at a future state in time.

Based on tangibility and measurability of the ERP benefits, they can be categorised into 5 dimensions such as *(a)* strategic, *(b)* managerial, *(c)* operational, *(d)* IT infrastructure and *(e)* organisational (Shang and Seddon, 2000).

- For example, these benefits include cost reduction, cycle time reduction, building cost leadership, operational control, reduced inventories, better data analysis, empowering employees (Shang and Seddon, 2000; Abdelghaffar and Azim, 2010).

- Major benefits such as reducing the cost of manufacturing operations and staff overheads which can be finally converted into margin earning and suitable investment resources are the usual targets in adopting ERP. This could enhance over all business operating even if it is not the intended outcome (Nguyen, 2009).

- Based on the amount to be spent, these ERP systems are not just like any other monthly IT expenses but they are capital in nature and hence, need analysis and adoption appraisal of ERP become necessary before investing in the ERP (Ballantine and Stray 1998).

In spite of lot of efforts put into planning, selection and spending of financial resources, many projects do not reach to successful conclusion as it has been in past with many ERP projects failing to keep up to their pledged performances. Hence, the historical results of poor success rate makes managers vary of the new system implementation (Acar *et al.,* 2005; Shin, 2006). Following section highlights the challenges faced whilst implementing ERP systems.

2.4.2 ERP Systems: An Immense Challenge

Problems with the adoption and implementation of ERP systems are well theorised in the literature. Although business organisations spend millions on ERP packages and the implementation process, there is widespread evidence that they experience substantial problems, predominantly during the factual implementation project. Over the past decade, the significant revolution and focus towards ERP adoption and implementation has forced top management to trade off for opting the system that is vital for their organisation in which their main aim is to generate the business value (as returns) from their huge investments (Ross and Vitale, 2000; Abdelghaffar and Azim, 2010). The author argues that this would only be practicable when the need for ERP systems' infrastructure would arise internally within the organisation. Alternatively, external pressures would force in creating such circumstances where customer focus or competition forces would require the organisation to adopt a system which can integrate the elements of its business. However, rationale for adopting and implementing new ERP systems can be different based on the contextual factors for every organisation. Also, post-selection factors which can affect implementation can be varied as per the internal conditions or external forces. There may be various reasons for such rejection or unsuccessful conclusion to ERP adoption and implementation as discussed below:

- Management may not be knowledgeable or obvious about the requirement of IT infrastructure such as ERP systems that what is reason for adopting and how they will proceed in this regard or whether such a capital investment is necessary for their organisation (Oakey and Cooper, 199; Levy *et al.*, 2001).

- A divergence is formed as most of the times managers do not realise, or are not experienced and do not understand the integration between their core business and IT processes, and organisation's positioning; and more importantly, they may also not know about the role that IT can play to their organisation (Macpherson *et al.*, 2003).

- Management of the organisation may not know that these new ERP systems can bring manifold synergies or benefits to their organisation as a whole and individually in each department (Southern and Tilley, 2000).

- Organisations may not have the required resources such as accessibility, skills and expertise, competencies or dynamic capabilities to fabricate any substantial productivity from these ERP systems (Bhagwat and Sharma, 2007).

- Globally organisations deploy sole ERP solutions for all its internal operations and subsidiaries. It is often noted that this type of practice leads to problems in local subsidiaries such as over budgeting and time resources spending, lack of technical expertise and compromises in business process (Sethi *et al.,* 2008).

- Several organisations are not capable in leveraging their existing ERP systems for take advantage of new business prospects surfacing with rapid market developments. Karimi *et al.,* (2009) argue that this behaviour establishes a fabrication of pretence with regards to ERP systems not being successful especially to the top management.

- It is often observed that the primary focus on ERP adoption and implementation often neglects post-implementation maintenance and support from an early stage after roll out in the lifecycle (Law *et al.,* 2010).

The abovementioned grounds form the basis for taking decision for adoption (i.e. acceptance) or rejecting the huge investing in ERP systems infrastructure. On acceptance to invest in ERP systems, it is often observed that different organisations follow different approaches while adopting and implementing ERP systems' infrastructure. However, the prime challenge faced by many organisations is the fit of new ERP systems within their existing IT infrastructure. Differences between an organisation's processes and functions with ERP modules can be attributed to the compatibility issue. Here comes the factual trial of skills and expertise when the ERP team attempts to correlate and offer a practicable procedure between these two groups of business needs. It is simply comprehensible that right fit would make the implementation faster and easy with higher chances of success rate. This viewpoint is reverberated by many advocates and a manifestation for large organisations rolling out ERP for all subsidiaries (Boonstra, 2006; Sethi *et al.,* 2008). The implementation process is particularly complicated at this stage where all organisational functions are integrated into one central data system as per design requirements of ERP (Allen and Kern, 2001).

This indicates that the implementation process is one of the most crucial stages in adopting and deriving benefits of ERP. Based on these reasons of adoption, targeted results and other organisational issues, one can categorise different deployment strategies for each stage of implementation and factors influencing the implementation. For the reason aforementioned, there is need to investigate such factors that influence the decision-making process for adopting and implementing ERP systems. Therefore, in the following section, the author discusses on ERP adoption and implementation.

2.4.3 ERP Failure

ERP systems are complex to implement and maintain. The rationale is to improve business functions or a process leading to performance improvement (Tarn et al., 2002). However, the difficulties such as management commitment, high costs, time lagging, employee conflicts and non-realisation of anticipated benefits result in ERP projects' failures (Aloini et al., 2007).

Failures of ERP projects are generated from negative impacts of risk factors. If organisation's risk management strategy is in control and appropriate to the possible risk factors then failure rates can be curbed. Risk avoidance is not always possible so there must be risk mitigation strategy that requires early diagnosis and management (Keizer et al., 2002). A risk management strategy as an iterative macro procedure with risk treatment as micro module embedded in it can prove to be useful for risk mitigation (Aloini et al., 2007; Keizer et al, 2002). Risk management strategies do not work for organisations as many executives consider risk management processes as extra workload and unnecessary expenses (Mark et al., 1998; Kwak et al., 2004).

Risk management's main job is to identify risk factors and associated impact level and its effects on project phases. Major failures can occur due to poor execution of project or risk management of the project as some risk like costs and time are prone to surface at any point during the ERP implementation. Failures can be classified as process, expectation, interaction or communication / correspondence failures. These stem from effects of risk factors or CSFs or uncertainty factors (Baccarini et al., 2004). Following table shows risk factors explained with high to low identification rate as reasons for ERP project failures.

Risk Factors	Identification Frequency Rate
Inadequate ERP selection	High
Ineffective strategic thinking and planning strategic	High
Ineffective project management techniques	Medium
Bad managerial conduction	Medium
Inadequate change management	Medium
Inadequate training and instruction	Medium
Poor project team skills	Medium
Inadequate BPR	Medium
Low top management involvement	Medium
Low key user involvement	Medium
Ineffective communication system	Medium
Inadequate IT system issues	Medium
Complex architecture and high number of implementation modules	Low
Inadequate legacy system management	Low
Ineffective consulting services experiences	Low

Poor leadership	Low
Inadequate IT system maintainability	Low
Inadequate IT Supplier stability and performances	Low
Inadequate financial management	Low

Table 2.1: Risk Factors of ERP Project (Source: Aloini, 2007)

The extant research indicates that 90% of SAP R/3 projects run late and 3/4th of the projects are considered as failure (Scott and Vessey, 2002). This can as well endanger the core operations of the organisation and severely affect the overall business of the organisation. Huang et al., (2004) found 28 risk factors for project failures while synthesising ERP risk into six categories: organisation fit, skills mix, project management and control, software system design, user involvement and training and technology planning.

2.5 ERP Adoption and Implementation

Evolution of using ERP has been influenced over the years in different countries through various reasons such as business culture, organisation's internal culture, resources available and competitive landscape including the ways employees and organisations perceive ERP systems' adoption (Hong and Kim, 2002). The main business case reasons for adoption usually consist of organisations searching to improve either part or whole of their business process, for example, information flow, order processing, quality control (Abdelghaffar and Azim, 2010). In this way, ERP systems' adoption helps the consolidation of fragmented business functions or information between organisations, suppliers and customers (Sharif *et al.,* 2005). ERP may act as a supporting tool to better decision-making by integrating business processes (Razmi *et al.,* 2009). For instance, the literature from USA and UK signifies the importance of ERP implementation and integration than any other components of ERP adoption in the organisation (Willis and Willis-Brown, 2002). The drivers of ERP adoption may be different but the central aim is information processing to improve the decision-making in the organisation (Spathis and Constantinides, 2003). Time and resources consumption cannot be avoided in adopting and implementing such a complex system with problems prone to occur in any lifecycle phase.

ERP adoption is based on the expected benefits targeted and analysed in the appraisal of the capital investment in the pre-implementation stage (Esteves, 2009). Same drivers of enabling ERP causes several changes in the quantity and quality of the information, business processes and brings cultural changes like employee attitudes (Loh and Koh, 2004). ERP is planned to integrate and to optimise the business process (Davenport, 1998), which usually costs $15 to 20 million. Even after such a capital expense, the system uses MRP as a main logic within its central function, which carries pitfalls of older and evolutionary versions of the system (Moon and Phatak, 2005). Hence, SSOs need to be cautious in designing, planning and selecting system or stand alone modules in pre-implementation stage. The integration of ERP works from the source of application to the target of application which passes through various stages of adoption and implementation and layers of the organisation (Doom *et al.,* 2010). The successful implementation of the system not only creates the expected benefits for the organisation but it re-structures other components of the organisational structure as well (Hong and Kim, 2002). The overall impact of successfully harnessing the ERP is organisation wide improvement in technological, performance and competitive landscape (Burca *et al.,* 2005). On the other hand, the subsequent impact of ERP is on the efficiency of the operations and effectiveness of business operations of the organisation (Mabert *et al.,* 2001). Once the benefits are derived within the organisation then management looks for obtaining synergies in their value chain extending to better management of customers and suppliers.

This can come from even post-implementation changes like adding customised modules such as Customer Relationship Management (CRM), supply chain quality planning, and e-commerce (Esteves and Pastor, 2001; Esteves, 2009). The integration of business process between internal organisational factors and external factors impact the interaction between manufacturing and marketing units of the organisation. This in turn can impact the profitability and competitiveness of the organisation. Also, this depends on factors such as structure, task, specialisation required, production procedures and objectives (Hsu and Chen, 2004). Tangible impacts can be reflected into the profitability and can support other quantitative measures like capacity planning, inventory, turn over, production quality control and production cycle time, whereas, intangible impact of successful implementation can be better resource allocation, information flow across the organisation, decision-making and business intelligence including customer satisfaction and loyalty criterion (Poon and Yu, 2010). This can be also categorised as functional and valuable impacts. The real impact of ERP adoption and implementation can be the increased flexibility of the organisation to generate information supporting the decision-making, performance control, and integration of managerial accounting applications (Spathis and Constantinides, 2004; Ngai *et al.,* 2008). The latter discussion clearly highlights the significance of ERP and its adoption and implementation. In order to further understand in depth the factors influencing ERP adoption and implementation, the author critically analyses the extant literature (including theories, models and frameworks) and extrapolate some relevant factors that can be considered as vital for the success of ERP in in the following section.

2.5.1 Investigating Factors for ERP Adoption and Implementation

Critical Success Factors (CSFs) can be defined as factors which can impact the success of ERP adoption and implementation either positively or negatively. Another perspective of investigating CSFs is to describe factors which can create obstacles in the path of successful implementation process. This can be overcome by using different impediments removal techniques (Kim *et al.,* 2005). They identified five major impediments such as: functional units' conflict, inadequate HR commitment, lack of change management expertise, non-aligned BPR for ERP and employee inertia for new system usage. Similar viewpoint is shared by Hong and Kim (2002) where ERP adoption and implementation success is analysed based on the 'organisational fit' perspective which takes into account causes failure rate as well as strategy and IT integration through organisational fit and implementation contingencies factors. These further include dimensions such as data – process – user fit, adaption level, cost, time and performance of ERP. These systems have evolved into a system which can provide sustainable competitive advantage through its ability to improve the process and to reduce the time consumption for functions in the organisation (Al-Mashari *et al.,* 2003). Such applications of IT/IS enabled improvements in the system lead to the increased traceability, integration between various modules, better storage and retrieving of information. Usual causes for this are complexities associated with ERP implementation and costs. This has led organisations with strong human and financial capital to enjoy advantages of this technological advancement over their competing rivals who did not adopt the system (Soh *et al.,* 2000). Cost-benefits analyses are conducted by all organisations as a project appraisal and return on investment measurement but real drawbacks impeding the successful outcome are embedded within the implementation stages where congruence between organisation's culture, strategic goals and execution of new ERP system is lost (Davenport, 1998).

However, the success and failure of the ERP adoption and implementation can be attributed to flaws in the planning, design, execution, communication and post-implementation expectations. These stages of ERP adoption and implementation involve different functional activities such as operational, managerial, tactical and hierarchical in any organisation (Shang and Seddon, 2000). ERP benefits can be realised by exploiting links between ERP adoption and implementation and business performance measures. Holland and Light (1999) mentioned that the management focus of the ERP utility provides two major categories of factors affecting ERP into strategic and tactical influence. Strategic factors are generated from corporate strategy alignment with ERP, whereas, tactical factors are generated from technical configuration point of view. Somers and Nelson (2004) developed the taxonomy of based on the key players and their activities as origin of CSFs for ERP project lifecycle. Based on the analyses of 116 organisations' ERP experience they state the importance of the key players such as: top management, project leaders, steering committee, consultants, vendors, employee project team; and their major activities such as: training, package selection, customisation, change management, communication, co-operation increases to a great extent. In their research model, Somers and Nelson (2004) suggest that in the earlier stages of own project top management, vendor and steering committee are observed as critical factors with their importance as high as 70% to 83% whereas in the later three stages, factors such as co-operation, communication, users and consultants, have turned out to be important.

Another research study of SMEs in UK by Loh and Koh (2004) has adopted process theory approach to find critical elements and their constituents. According to their claim, success factors are separated as critical elements from critical people and critical uncertainties. This considers ERP as an integrated architecture with five major elements: production; administration and control; human resources; inventory and warehouse management; and database management. Most important factors are: project champion, project management, business plan and vision, and top management. Also, other significant factors are: support, effective communication and team work, BPR, minimised customisation, change management, culture, software development, testing, trouble shooting, monitor, and to evaluate the performance. The process theory approach has become very significant for ERP implementation as it is able to provide organised view of events leading from start to end. In addition to this advantage, it offers the detailed analysis of each phase focusing on various components of ERP. Literature also provide major and CSFs such as: business plan and vision, change management, communication, team composition, skills and compensation, project management, top management support and project championship, system analysis - selection and technical implementation (Nah *et al.*, 2001; Dawson and Owens 2008; Doom *et al.*, 2010; Upadhyay *et al.*, 2011 and Maditinos *et al.*, 2012).

The project management view generated based on the size, resources and effects of the ERP can even be termed or be comparable as enterprise wide portals implementation. Remus (2007) compared ERP and portals implementation only to find that they differ in scale, scope, complexity, resources, and costs but have similar success factors. CSFs such as design, selection, top management support, change management, user training and acceptance, vendor support, communication are common between both types of projects (Remus, 2007). Similar CSFs are found in the large scale mail survey research by Muscatello and Chen (2008). These are strategic initiatives, executive commitment, human resources, project management, information technology, business process, training, project support, communication, software selection and support. Francoise (2009) uses an innovative approach of filtering CSFs based on their relevance to difficulties and actions in a project implementation approach. Applying the Actions-Critical Success Factors (A-CSF) method, major CSFs extracted by Francoise (2009) comprises of: project team work and composition, organisational culture, change management, top management support, business plan and long term vision, business process re-engineering and customisation, effective communication and project management, testing, monitoring of system and organisational structure. Dezdar and Sulaiman (2009) adopt content analysis approach of extensive literature and develop the taxonomy of ERP implementation CSFs. The CSFs are thus grouped into three major environments of ERP system, organisation and implementation success. These environments are sub-divided into ERP technology, external expertise, project success, business success, ERP user and project.

More recently, researchers such as Doom *et al.,* (2010); Upadhyay *et al.,* (2011) and Maditinos *et al.,* (2012) have focused on developing a view of CSFs in relation to ERP implementations in SMEs, empirically assessing the factors that are most critical in the ERP implementation process from the perspective of Indian micro, small and medium-scale enterprises (MSMEs), and examining the causal relationships between seven CSFs that belong to these three dimensions of human inputs, ERP consulting process and consequence, respectively (detailed list of CSFs presented in Appendix B). As ERP has been discussed based on different perspectives, it involves targeted improvements in the business process, decision process, management focus, IT and IS structures, products or positioning of the companies. From the stakeholders' perspective, people involved from different departments of business transaction in ERP adoption and implementation allow easy resource allocation and team formation for the whole project (Boonstra 2006). From process perspective, when ERP is to be implemented throughout the organisation and a major reason to adoption is restructuring of the business and its competitive position, it is beneficial to adopt and to plan ERP implementation with a business process view (Gardiner *et al.*, 2002). From a technical perspective, ERP can either be installed as standard set or modified according to end user requirements. From organisation perspective, need analysis of ERP is the first requirement which fits the ERP benefits into the gaps of organisational requirements. This view provides the remedial measures of organisational building (Gardiner *et al.,* 2002). From project perspective, needs large amount of financial resources so its adoption is based on the project analysis using capital project appraisal methods where risk and returns are weighed against each other to evaluate the ERP system for the organisation (Shang and Seddon 2002).

Literature indicates several factors (e.g. including among others are top management support and commitment, external support from consultants, vendor partnership, project champion, etc) that have been discussed by many researchers to understand the area of ERP adoption and implementation. Such factors that can also be considered as vital factors that have been discussed in the context of large organisations, SMEs, public and government organisations. These factors have been used by researchers interchangeably to discuss ERP within their respective context. The author also considers these factors as vital because these factors have been empirically evaluated through plethora of case studies and survey based research in different sector organisations, thus, may also be considered as vital factors for ERP adoption and implementation in SSOs. As what Fichman (1992) acknowledged for the IT/IS adoption and implementation process to differ from sector to sector, it is also expected that investigation and evaluation of factors from the extant ERP research may offer wider understanding and applicability for ERP adoption and implementation in SSOs. The following Table 2.2 presents a classification of the factors that have been discussed by researchers several times in their respective research studies with complete table with reference presented in Appendix B. The first column highlights the different types of factors related to ERP discussed in the literature, and second column illustrates the frequency (i.e. times) each factor has been cited and discussed in the literature.

Factors Related to ERP Adoption and Implementation	**Frequency of Factor Appearance in the Literature**
Top Management Support, Executive Commitment, Senior Management Support, Empowered Decision Makers, Steering Committee.	28
Project Management, Project Schedule and Plans, Project Support, Project and Application Integration.	22
Change Management, Process Change, Commitment to Change, Managing Change, Expectations Management, Process Change.	20
Effective Communication, Interdepartmental Collaboration, Organisational Communication	20
Business Vision, Clear Goals and Objectives, Pre-Determined Goals Achievement.	18
Project Champion, Personnel, Personnel Reduction.	17
Business Process Configuration, Management, Process Change, BP Improvement, Process and Application Integration, Process Adoption, BPR, Business Process Modelling, Alignment with business processes.	17
ERP Team and Composition, Project Team, Team Competence, Balanced Team, Best People Full Time.	17
Training and Education, Education on New Business Process.	14
Package Selection, Software Selection and Support, Defining Architecture Choices.	11
External Consultant, Client Consultation, External Support, Hiring Consultants.	12
Customisation, Minimum Customisation, Vanilla Approach, Implementation Approach, A formalised	11

project approach and methodology.	
User Involvement, Client Acceptance.	8
Culture and Structural Changes, Organisational Culture, Employee Morale.	8
Performance Evaluation and Management, Effective Use of ERP Features/Applications, Monitoring and Evaluation of Performance, Focused Performance Measures, Benchmarking, Monitoring and Feedback.	8
Legacy Systems, Appropriate Business and Legacy Systems, Business Case.	8
System Testing, Trouble Shooting.	9
Vendor Partnership, Vendor Quality, Vendor Support, Vendor Tools, Vendor's staff knowledge.	8
System Quality, System Integration, Portal Engineering Roadmap, System Development, Software Development, Configuring System, Multi-Site Issues.	6
Budget, Deliverable Dates, Cost.	7
Information Quality, Compatibility, Data Accuracy, Information flow management.	7
IT Infrastructure, Infrastructure and Dedicated Resources.	5
Appropriate IS Staffs, User Fit, User Knowledge, User Support.	5
Implementation time, On time, Time to Market Reduction, Implementation Time.	5
Strategy of ERP, Strategic Intent, Portal Strategy, Implementation Strategy.	4
Strategic Planning, Strategic Initiatives.	2
Final Preparation, Going Live, and Pilot Testing.	2
Inventory Reduction.	1
CEO-IT Distance.	1
Individual and Work Group Impact, and Organisational Impact	1
Operational Quality.	1

Table 2.2: Classification of ERP Factors –Literature Appearance Frequency

2.5.2 Investigating ERP Adoption and Implementation Lifecycle Phases

Management literature has developed and applied lifecycle modelling for industry, products, services, employee tenure, systems and projects. The key to use such modelling approach successfully is to be able to review, analyse, interpret and design lifecycle which can encompass the whole process in each phase (Topi *et al.*, 2009). Two most widely used concepts are: *(a)* object oriented analysis and design *(b)* the lifecycle model. The most common method for designing the information system is systems development lifecycle. This primarily may consist: investigation, analysis, design, implementation and maintenance as its phases (O'Brien and Marakas, 2007). Topi *et al.*, (2009) divided any technology adoption and implementation lifecycle into four major phases: planning and selection, analysis, design and implementation and operation. Information technology adoption can be realised as an organisation's particular decision to adopt in IT in order to improve the operations of the organisation (Paul *et al.,* 2000). Darmawan (2001) provided IT implementation model consisting of four main phases: initiation, adoption, implementation and evaluation based on the influencing factors, adoption and data levels in the organisation. Considering IT project based on costs, benefits and risks analyses as selection criteria, Stewart (2008) developed lifecycle management phases. These lifecycle phases are termed as selection, strategic implementation and monitoring, and performance evaluation. Each this phase is also developed into a framework which contains different logical steps.

According to Gallivan (2001) and Frambach and Schillewaert (2002), technology adoption and implementation lifecycle entails a number of stages – those stages that an organisation crosses through while adopting and implementing a technology. The latter is supported by Rogers (1995), who proposed an adoption process, including stages such as: *(a)* knowledge of an innovation, *(b)* forming an attitude toward the innovation, *(c)* decision to adopt or reject, *(d)* implementation of the new idea, and *(e)* confirmation of this decision. Furthermore, Gopalakrishnan and Damanpour (1997) reported two prime stages with regards to adopting technology, such as the initiation (e.g. where the organisation becomes aware of the technology, forms an attitude towards it acceptance and further evaluates the new technology) and the implementation (e.g. where the organisation decides to purchase and make use of IT) of the innovation. On the other hand, such organisational adoption decision marks simply the commencement of the real implementation of technology. From this point onwards, the acceptance of technology becomes vital in the organisation. According to Gopalakrishnan and Damanpour (1997) and Rogers (1995), technology adoption and implementation process is a success only when technology is acknowledged, accepted, used and incorporated into the organisation.

Lifecycle concept is not new as researchers have developed model for economic lifecycle, product lifecycles, and innovation lifecycle, etc. The more important view is to explore the applicability of the lifecycle concept to ERP implementation. Many authors have given different model in terms of ERP lifecycle phases but their central theme is echoed in one direction. That, from considering the idea of adopting the ERP to realising the benefits of implementing ERP in the organisation is a multi-segment process (Welti, 1999; Al-Mashari, 2006). Herein, the author would like to divide the ERP lifecycle into three broad phases: pre-implementation, implementation and post-implementation. The latter division is also supported by (Parr and Shanks 2000). Models presented by other researchers have been classified according to their importance, time and resources utilisation into three main phases as discussed below.

- **Pre-Implementation Phase**

The frameworks are usually structured in different phases and dimensions. Phases can be defined as components of ERP system implementation within an organisation, whereas, dimensions are viewpoints based on which these lifecycle phases can be analysed (Esteves and Pastor, 1999). Pre-implementation phase may include the segments of activities accomplished for reaching to implementation ready phase. These can be need analysis, planning, vendor search- comparison, system selection, resources allocation and pilot testing before the actual implementation phase. This may operate like managing a project. Esteves and Pastor (1999) divided ERP lifecycle into six phases: *adoption decision*, *acquisition*, *implementation*, *use and maintenance, evolution* and *retirement*. One can categorise these phases of adoption and acquisition into pre-implementation, as during these phases managers analyse the needs of ERP, collect general information, fit ERP with required business challenges, goals and benefits and measuring impact of future implementation. Before acquiring the system, managers have to analyse system's price, training to their staff and maintenance of the system as well.

One such framework is an 'IT investment to business value' framework proposed by Soh and Markus (1995). They categorised the process into conversion, usage and competitive dynamics starting from acquisition expenditure to achieving organisational performance from the implementation of system. Based on this framework, Markus and Tanis (2000) developed model of enterprise system experience cycle diving it into four phases: *project chartering*, *project configuration and roll out, shakedown* and *last continual phase of onward and upward*. In their view, each enterprise system may prove to be unique in terms of stakeholders involved, activities carried out, problems associated with and range of resources and possible outcomes. Chartering phase and configuration activity of dollars to asset phase may fall into the category of pre-implementation from this model. Chartering may consist of activities such as idea surfacing, business case development, key performance indicators, current status analysis, selection of software, hardware, networking, database system, implementation partner selection, rollout planning, organisational resources and team building and a final appraisal and decision to approval of project's capital investment. Lack of information, understanding, resources and inter-management conflicts with unrealistic goals and any overselling by vendors may create problems, which in turn would affect the remaining phases and possible outcomes of ERP implementation. Configuration may be still defined as pre-implementation activity because it is well before implementation or roll out. Configuration mainly includes the detailed development of whole project plan, selection and training of project team, software system customisation and change management plan. This discussion of pre-implementation phase is based on a set of activities and planning but other views of outcome and process theories can offer more detailed insight to this.

The outcome based performance view of ERP implementation phase is proposed by Ross and Vitale (2000) where they stress more importance to outcome of ERP implementation in terms of stabilisation, continuous improvement and transformation of organisational systems. The pre-implementation is termed as design phase by Ross and Vitale (2000) as they consider all activities and its outcome before implementation during this phase. Design phase in their proposed concept includes an approach to planning where organisations make two vital decisions: *(1)* initially about the business process change or improvement planned and *(2)* the other about standardisation of the process. According to Markus and Tanis (2000), process considers implementation as a sequence of phases each with intermediate output which has effects on final result of implementation. Based on process models by Bancroft *et al.,* (1998), Ross (1998) and Markus and Tanis (2000), Parr and Shanks (2000) developed concept of Project Phase Model (PPM) for ERP implementation. They further stated that previous three models do not relate CSFs to the implementation phases and they either combine many activities into one unit or collapse the actual implementation into one discrete unit. PPM model consists of three major phases *planning*, *project* and *enhancement*. Out of these three, planning phase can be considered into pre-implementation phase which is said to be having ERP selection, assembly of steering committee, determination of project scope, broad implementation approach, and selection of team and resource determination. Extending Parr and Shanks (2000) model with empirical confirmation, Peslak *et al.*, (2008) considerd ERP lifecycle phases into four: *preparation and training, transition, performance and usefulness, and maintenance*. The more significant pre-implementation phase from their research is preparation. The effective management of IT can be viewed as structured and cyclic business process.

Rajagopal (2002) stated that IT implementation procedures can be classified as factors, process and political research bases. Using factors type research which can address individual – organisational and technological issues such as ERP implementation, Rajagopal (2002) developed causal model. This causal model comprises of basic IT implementation framework proposed by Kwon and Zmud (1987). This framework consists of six stages of implementing IT system like ERP. These stages are *initiation, adoption, adaption, acceptance, routinization and infusion*. Intiation and adoption can be considered in this pre-implementation stage which may include activities of competition analysis, rapid decision making, cost-benefits appraisals and system selection in a timed phase. Synthesizing above all different concepts of IT implementation, IS management, BPR, project management and change management concepts into one integrated model, Al-Mashari *et al.*, (2006) categorised ERP lifecycle into four stages as *analysis*, *planning and design*, *implementation* and *post-implementation*. They consider analysing resources, business process, impacts and external environment including testing, designing and training into pre-implementation phases. Furthermore, Chang *et al.*, (2008) divided lifecycle concept itself into three segments *lifecycle process of ERP*, *life supporting cycle processes* and *organisational lifecycle processes*. Evaluation and acquisition phase includes set of activities for determining that ERP system is conducive, advantageous, affordable and relevant to needs and resources of the organisations. This are carried out before formal introduction of system to the organisations operations and thus, included in pre-implementation phases. Hence, this pre-implementation phase includes from an idea of having ERP to final pilot testing of actual rolling out the enterprise wide system.

- **ERP Implementation Phase**

Esteves and Pastor (1999) proposed that implementation phase includes customising the system to organisation's needs, parameterisation and adaption of the ERP package selected for implementation. The most important aspect of this phase is know-how and full training about use and maintenance of the system to employees and this would be the largest investment made for the training during the whole lifecycle. This is supported by Peslak *et al.*, (2008) considered training the more significant phase and Chang *et al.*, (2008) as they suggested that training is part of every phase and its investment is critical during formal introduction phase that is implementation. With large investments made during this phase, it can be described as dollars to assets that is getting the system and putting into use and running (Markus and Tanis, 2000). All the stakeholders become active in this phase and this includes any last minutes bug fixing, rework, testing, rollout and start up.

The problems in this phase may include staffing teams from all departments, difficulties in acquiring skills, poor output and un-organised documentation, configuration and customisation errors. These problems can lead either to temporary shutdown or indefinite project termination. This may affect functionality, operational performance and organisational performance of the firm in short term or long term. For example, if roll out is like big bang approach worldwide for all branches of the business then even a minor problem can cause a disaster (Markus and Tanis, 2000). According to Ross and Vitale (2000) even if careful planning is done for implementation, it is difficult to adopt new system and new processes separately as they are highly interlinked and interdependent. It will not be the same business process again as new system is designed till another innovation, idea or advancement come into existence. It leads to new organisational environment and can even affect organisation's culture. New system requires constant support and monitoring to a stage where it becomes part of the organisational culture, business processes and strategies. Contrary to this discussion, Parr and Shanks (2000) include all phases from *setup*, *reengineering*, *design and configuration* to *testing and installation* in the implementation phase. The underlying assumption for such wider scope of activities is about the basis of model as an implementation project itself. Hence, Parr and Shanks (2000) include all actions of ERP identification to installation and cut-over in this phase.

From IT implementation model of Kown and Zmud (1987) as analysed by Rajagopal (2002), it can be understood that considering how end users respond to new system, implementation can have three phases of adaption – *formal introduction* and *installation*, *acceptance* – increasing use of system with required modification and more training and routinisation where users have completely accepted the system and its usage has become daily activity and part of organisational culture. The theoretical perspective of Al-Mashari *et al.*, (2006) includes dealing with organisational, business and technical risks in this part of implementation because the final outcome is dual in the form of successful project completion and acceptance of change in the organisation. Hence, project management and change management are crucial consideration according to Al-Mashari *et al.*, (2006) in the implementation phase. The above discussion shows that successful training of employees and other performance indicators of ERP implementation as a process change, as a project installation and an organisational change are important dimensions of this lifecycle phase.

- **Post-Implementation Phase**

One can say that success of the implementation phase can be reflected in post-implementation as much of resources are invested and are utilised during ERP implementation to produce quality performance to achieve pre-set targets. Hence, post-implementation can be termed as output of input implementation phase. It is like the use of products resulting into increased benefits and reduced disruption (Esteves and Pastor, 2001). Peslak *et al.*, (2008) considers post-implementation phase consist *performance and usefulness, and maintenance*. The functionality – relevance and fitting the system into process, usability – utility and usage of system that it is providing what it is supposed to provide and adequacy – that system is satisfying all the requirements detailed in the need analysis, business case and planning. This can be known only when it is implemented and issues such as corrections for malfunctions, optimisation requests, additional reports and analyses are met. Further, extension and integration include ‘upward’ – output information supporting the planning, decisions and business intelligence and ‘outward’ – environmental interaction to increase network for suppliers, customers and other management stakeholders (Esteves and Pastor, 2001).

The output in this phase decides the realisation of benefits for the resources invested and takes the process and content of the ERP usage to the maturity stage (Holland *et al.*, 2000). Main reasons cited for the successful outcome in post-implementation phase are acceptance of the technology, functionality and system fit with organisational culture, value addition by the system (Fahy and Lynch, 1999; Kelly *et al.*, 1999; Granlund and Malmi, 2000; Stijn and Wijnhoven, 2000). Once it is known that system is working to the expected efficiency, it can be modified and be improved by adding more functional capabilities, which can provide added benefits and advancements to planning, supply chain, CRM and stakeholders’ collaboration. This improvisation and addition and deletion of the unnecessary functions run up to a point where an implemented system becomes obsolete in the market or new technology gets developed. This leads organisations to re-analyse their options again and select better system as substitution while retiring the existing one (Esteves and Pastor, 2001). This may need a joint review and audit of the present system’s operations, maintenance and deliverables including expansion – termination trade off (Chang *et al.,* 2008).

Retirement of the system in post-implementation does not always mean obsolete system but same system can be supported and upgraded to increase organisational performance as onward and upward characteristics. If organisation has long term plans at the time of selecting system with modifications and up gradations availability, it would be easy to carry out this instead of spending the resource and time again for new system (Markus and Tanis, 2000). If the reason for ERP system's failure turn out to be the unwillingness of employee acceptance organisation wide or inability of the system to improve business process or organisational performance then it may be necessary for management to think about options like upgrading the system or investing more finances and other assets for a new system deployment (Markus and Tanis, 2000). Stabilisation, continuous improvement and transformation as indicators of performance deliverables in post-implementation phases are vital to the success of the project. Time periods for these sub-stages after implementation depend upon the individual planning and context of the organisational issues. During these stages after sales support from vendors and further training to employees are crucial elements (Ross and Vitale, 2000). On the other hand, Parr and Shanks (2000) considers last phase as enhancement in their project phase model of ERP implementation. As the name suggest, they stresses on analyses of CSFs and then improvement of ERP functions and usage in the enhancement. This minimizes the chances of termination and new system requirements.

Rajagopal (2002) using Kwon and Zmud (1987) IT implementation model explains that post-implementation is about routinisation and infusion till next innovation. This innovation may be internal or external to the organisation. Rajagopal (2002) advocates for activities like flaws correction, organisational integration, benefits derivation, enhanced functional co-ordination to make newly installed ERP system as routine to organisational culture. The infusion may become necessary when competition scales higher altitude and global level IT integration is required for the organisation to stay competitive. Also, when advancements in the technology are not available and substitute systems are similar, the only option for organisations is the improvement rollout in the existing system. As Al-Mashari *et al.,* (2006) stated that many managers take post-implementation phase easy to manage but that is not so looking at long term benefits planned during the pre-implementation and argued for in the business case of ERP. In this context, leadership, top management commitment and communication between stakeholders hold the key for success. The shakedown and turbulence are part of the post-implementation but following a road map with help of vendors team can lead to overall success of implementing ERP. Most recent is the perspective of post-implementation consideration of Maintenance and Support (M & S) requirements, and IT governance practice as integral elements for successful ERP adoption and implementation. On the basis of business process change and customisation issues along with impacts from strategies and practices on the M & S, Law *et al.*, (2010) provided ERP lifecycle phases as *initiation, contagion – implementation factors, control and integration – maintenance and support factors.*

Key findings from the literature as discussed above is summarised in Table 2.3, which proves to be basis for ERP Adoption and Implementation lifecycle phases.

Author	**ERP Lifecycle Phases**
Esteves and Pastor (1999)	1. Adoption Decision 2. Acquisition 3. Implementation 4. Use And Maintenance 5. Evolution 6. Retirement
Markus and Tanis (2000)	1. Project Chartering 2. Project Configuration and Roll Out 3. Shakedown 4. Onward And Upward
Parr and Shanks (2000)	1. Planning, 2. Project 3. Enhancement
Rajagopal (2002)	1. Initiation 2. Adoption 3. Adaption 4. Acceptance 5. Routinization 6. Infusion
Al-Mashari et al (2006)	1. Analysis 2. Planning and Designing 3. Implementation 4. Post-Implementation
Peslak *et al.*, (2008)	1. Preparation and Training 2. Transition 3. Performance 4. Usefulness Maintenance
Chang *et al.*, (2008)	1. Lifecycle Process of ERP 2. Life Supporting Cycle Processes 3. Organisational Lifecycle Processes
Law *et al.*, (2010)	1. Initiation 2. Contagion 3. Control 4. Integration

Table 2.3: ERP Adoption and Implementation Lifecycle Phases –Literature Appearance

2.5.3 Overall Critique

The abovementioned research studies present a number of key factors influencing the decision-making process for ERP adoption and implementation. Several viewpoints can be extracted from these research studies: *(a)* these studies indicate the significance of ERP adoption and implementation not only in SSOs but other sector organisations and *(b)* these studies offer insights into a number of influential factors. The author argues that although all the above discussed factors provide an understanding of ERP systems, nevertheless, there are:

- Limited studies highlighting the importance of factors influencing the decision-making process for ERP adoption and implementation. Somers and Nelson (2001) reports that factors can be considered as sited exemplars that support in extending the boundaries of process improvement. Moreover, their effect can be characterised as much richer if viewed within the context of their importance in the implementation process. Factors discussed in the latter research studies may be regarded as all important but herein, the author denotes the importance as – categorising the importance based on 'most important' to 'least important' in a ranking format.

- There are limited research studies that discuss on ERP lifecycle stages, e.g. Somers and Nelson (2004) integrate the factors approach with the six-stage (initiation, adoption, adaption, acceptance, routinisation and infusion) IT implementation stage model (initially proposed by Rockart, 1979) and provide the more comprehensive research model of ERP implementations. The researchers mapped their proposed factors on these six stages. However, this study is one of its kinds that merely focus on ERP factors and stages. This study lacks in identifying the significance of factors influencing ERP adoption and implementation. Literature indicates that lifecycle concept is not new as researchers have developed model for economic lifecycle, product lifecycles, innovation lifecycle, etc. The vital viewpoint herein is the applicability of this concept in the context of ERP adoption and implementation. However, there are different model in terms of ERP lifecycle, stages and phases but their central theme is echoed in one direction. That, from considering the idea of adopting the ERP to realising the benefits of implementing ERP in the organisation is a multi-segment process (Al-Mashari, 2006). The research conducted herein focuses on ERP lifecycle in the context of pre-implementation, implementation and post-implementation. These are discussed in detail in Chapter Three.

- The intent of this research is to prioritise the importance and map the factors influencing ERP adoption and implementation on ERP lifecycle stages. To the best of the authors' knowledge, there is lack of broad-based theoretical and empirical research on discussing on prioritising the importance of factors and mapping of factors on ERP lifecycle stages in the context of SSOs. Integrated infrastructure is certainly a worry for the SSOs (Ahmad *et al.*, 2007). Therefore, given the increasing attention towards ERP adoption and implementation by academics and practitioners, the author endeavours to further explore the prioritisation of factors, ERP lifecycle phases and stages, and mapping of factors on different ERP lifecycle phases and stages in SSOs. The inevitability for comparatively comparable research has been emphasized in the literature (Pilat and Devlin, 2004; Léo and Philippe, 2006; Rai and Sambamurthy, 2006; Ahmad *et al.*, 2007; Ozyilmaz and Berg, 2009; Uwizeyemungu and Raymond, 2011).

The important research issues derived from the literature review conducted in this chapter are summarised in Table 2.4:

Research Issues for Further Investigation	
Research Issues	**Description**
ERP Adoption and Implementation Models	• Lack of research studies on enterprise resource planning adoption and implementation models in the context of SSOs.
Prioritising ERP Adoption and Implementation Factors	• Existing enterprise resource planning research does not prioritise the factors based on their importance in the context of SSOs.
ERP Lifecycle Phases and Stages	• Limited research focusing on enterprise resource planning lifecycle phases (i.e. pre-implementation, implementation, post-implementation) and stages in the context of SSOs.
Mapping ERP Adoption and Implementation Factors on ERP Lifecycle Stages	• Existing enterprise resource planning research does not map the influential factors on enterprise resource planning lifecycle stages.

Table 2.4: Highlighting the Research Issues

These research issues are taken into consideration and addressed in Chapter Three.

2.6 Conclusion

This chapter assesses the ERP literature and extracts research issues in the area of the SSOs. In this manner, the author ascertains a literature void dealing with the deficiency of conjectural research (including any model or framework) for ERP adoption and implementation in SSOs. The interpretation for this is that ERP, although not a new area but comparatively limited in-depth research is conducted specifically in SSOs. Even though, there exist several ERP research studies on ERP adoption and implementation, nevertheless, the author asserts that all these research studies may seem pertinent but their authenticity and applicability in SSOs is debatable. SSOs are complex organisations in the context that they specifically focus on proving services as compared to others that offer tangible products. Some service provision organisations e.g. education sector, government sector, healthcare sector are administered by authorisation and regulations, also some of them have dominant nature with allegiance to out-of-date social principles, and their information systems adoption and implementation entail scattered decision-making based on a partition of management and authority. With such manifestation reported in the literature, it can be argued that an abyss exists in relation to ERP adoption and implementation in the SSOs.

The author in this chapter commences by critically reviewing IT adoption and implementation literature in SSOs. The author converses on the focus of SSOs on IT adoption and implementation over the last several years. The review of IT adoption and implementation in SSOs highlights that even though SSOs have adopted and implemented a number of information systems to enhance their operational practices, on the other hand, in spite of everything several limitations exist (as discussed earlier in this chapter). These limitations are based on the literature findings from several research studies conducted on the service provision domain. To provide a better comprehension on ERP adoption and implementation in SSOs, the author at the outset interprets ERP, after that ERP benefits realisation and core challenges. Subsequently, the author exemplifies the existing research conducted on ERP adoption and implementation in SSOs.

3

Chapter Three: Developing a Conceptual Model

3.1 Introduction

In an attempt to further investigate the research issues extracted from the previous Chapter Two, this chapter emphasizes the main research issues that: *(a)* though there are several ERP adoption and implementation models and frameworks theorised in the literature, there is limited research conducted on ERP adoption and implementation in the context of SSOs, *(b)* organisations from the public and private sectors have different decision-making processes, organisational structures and cultures compared to SSOs thus, it may be possible that SSOs concentrate on different CSFs or may require a more CSFs for the adoption and implementation of ERP systems, *(c)* existing ERP adoption and implementation models also do not prioritise the CSFs (as highlighted in Chapter Two) from most important to least important, and *(d)* existing ERP adoption and implementation models do not map the influential CSFs on different stages of the ERP lifecycle. The author uses the critical analysis of the literature as reported in Chapter Two to further analyse the area under study.

3.1.1 Chapter Objectives

The purpose of Chapter Three is to develop and propose a conceptual model for ERP adoption and implementation in SSOs. To achieve this objective, a conceptual model will be developed based on four dimensions: *(a)* identify factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* identify ERP adoption and implementation lifecycle phases and stages, and (d) mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages.

3.1.2 Chapter Structure

In Section 3.2, the author deals with developing ERP adoption and implementation model in SSOs. Section 3.2.1 proposes a list of influential factors from the general literature including SSOs that may assist in providing support in developing ERP adoption and implementation model in SSOs. Thus, on further investigating the latter literature voids; initially Section 3.2.2 investigates the importance of factors influencing ERP adoption and implementation i.e. prioritising the importance of factors. This section assists in building an understanding of how existing literature prioritises the factors. Thereafter, in Section 3.2.3, the author proposes the ERP adoption and implementation lifecycle phases and stages. Moving onto Section 3.2.4, the author focuses on the focal theory of mapping of the factors influencing ERP adoption and implementation on different ERP lifecycle phases and stages. In piecing together the factors, prioritisation of factors, lifecycle phases and stages, and mapping of factors, a conceptual model to study ERP adoption and implementation in SSOs is proposed in Section 3.2.5, with Section 3.3 summarising the conclusions.

3.2 Developing ERP Adoption and Implementation Model in SSOs

ERP has been there in the market and academic literature for more than two decades, indicating that it has been well investigated. Moreover, a number of ERP implementation models have been proposed and studies conducted on ERP, also illustrating a number of influential factors (Appendix B) however, none of these models highlight the factors, prioritisation of factors, adoption and implementation lifecycle phases and stages, and mapping of factors as collectively to offer a systematic process to improve the decision-making in SSOs. According to Kurnia and Johnston's (2000) research to adapt a model or framework, it is vital to modify the model or framework according to the context it is applied to. Thus, to the best of the author's knowledge, the model proposed by Kamal (2008) is the foremost available resource of reference in this area that specifically discusses the factors, adoption lifecycle phases, mapping and prioritisation of factors but related to Enterprise Application Integration (EAI) technologies. The initial rationale for taking this model (Figure 3.1) as the basis of this research is that local government authorities are service oriented government organisations that provide services to their citizens, employees, other government agencies, and business partners, similarly, SSOs offer specific services to their clients/consumers.

Secondly, Kamal's (2008) EAI adoption model is about improving the decision-making process in local government authorities, whereas, in the context of this research, it is about improving the decision-making process for ERP adoption and implementation in SSOs. Thirdly, EAI is a set of integration technologies, whereas, ERP are integrated systems that require EAI technologies to be integrated with other systems developed with different platforms and operating systems. Fourthly, as there are few factors that are described in Kamal's (2008) EAI adoption model are also considered suitable to study in the context of

ERP in the literature e.g. top management support, IT infrastructure, project champion. Thus, due to the absence of theoretical models for ERP adoption and implementation in SSOs that follow this systematic approach (i.e. investigating factors, adoption lifecycle phases, mapping and prioritisation of factors to improve the decision making process), and similarity of domain in terms of 'service provision', Kamal's (2008) EAI adoption model (Figure 3.1) is considered as an appropriate basis model to study ERP adoption and implementation in SSOs. However, in this research the author instead of completely following Kamal's (2008) proposed systematic process i.e. investigating factors, adoption lifecycle phases, mapping and prioritisation of factors to improve the decision making process, slightly modified the systematic process. Instead the author followed: investigating factors, prioritisation of factors, adoption and implementation lifecycle phases and stages, and mapping of factors to improve the decision making process. The rationale to differentiate is that this research is about adoption and implementation whereas, research proposed by Kamal (2008) merely focused on adoption.

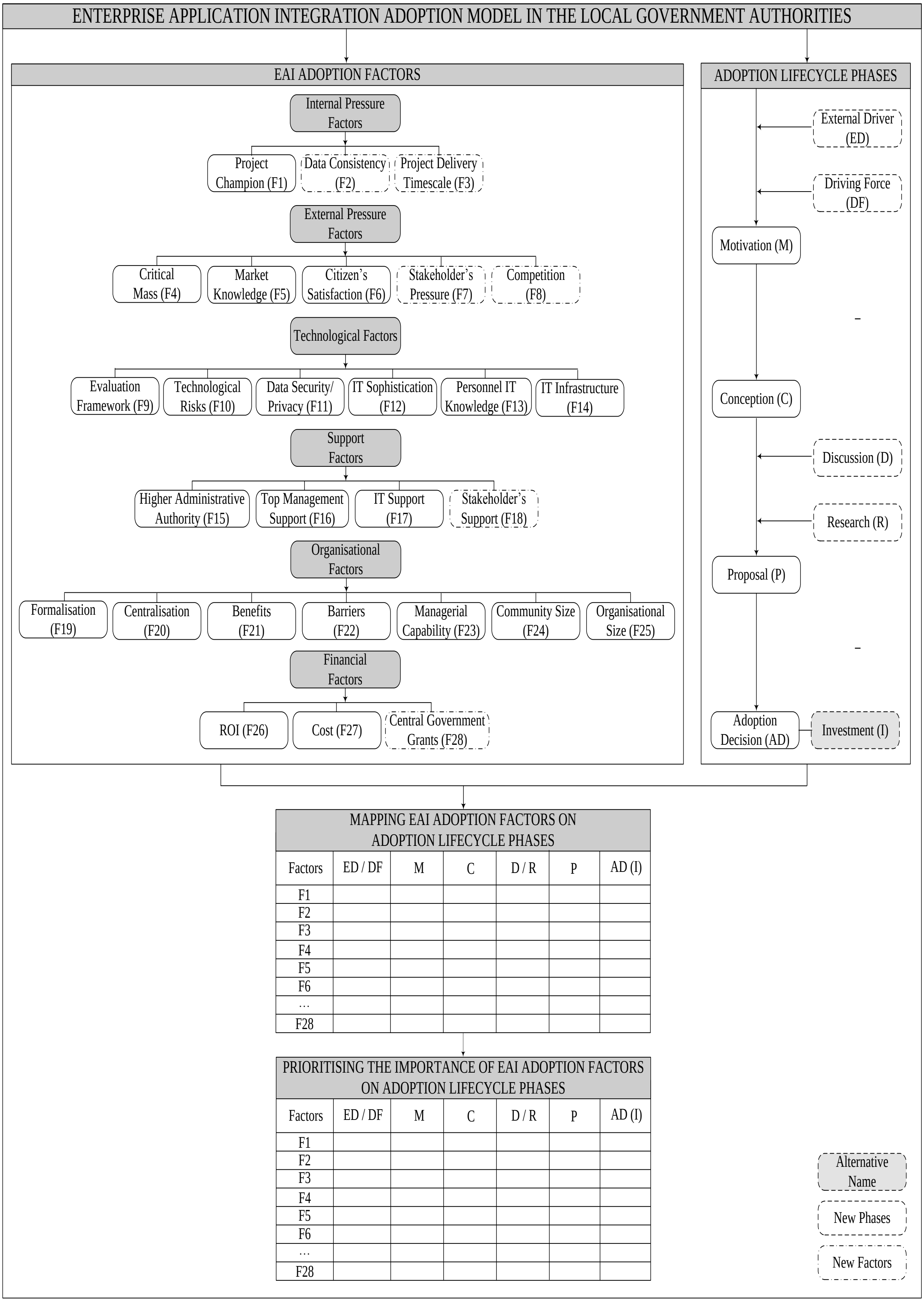

Figure 3.1: EAI Adoption Model in Local Government Authorities *(Source: Kamal, 2008)*

3.2.1 Proposed Factors for ERP Adoption and Implementation in SSOs

ERP factor categories provide an opportunity for managers dealing with ERP projects to emphasize the area in which problem might take place. Moreover, each of these categories has different vision by managers for ERP utilisation that makes them distinct from one another and relates to different set of critical success factors. The purpose of these categories is to facilitate the managers in better understanding the factors influencing ERP adoption and implementation. Literature indicates a number of categories and their associated factors. For example: Holland and Light (1999) categorised ERP implementation CSFs into strategic and tactical. Esteves and Pastor (2000) classified CSFs into organisational and technological. Sun et al., (2005) presented a framework of five categorisation of ERP CSF implementation, consisted of management/organisation, process, technology, data and people. King and Burgesss (2006) present a combined model of ERP success/failure showing a cycle of development operations, supporters, organisation, and project organisation.

In Section 2.5.1, the author highlighted a number of factors that have been discussed and utilised in the literature several times. These factors play an important role in ERP adoption and implementation i.e. offering a better understanding of the ERP adoption and implementation process. The analysis of the aforesaid factors illustrate that they cover the broad scope of the organisation in different sectors. These factors provide sufficient support to the author to consider some of the most important ones for developing an ERP adoption and implementation model in SSOs. The author selected factors that may support in developing a conceptual model for ERP adoption and implementation in SSOs. These factors that have been selected by author based on the frequency of factor in the literature and importance to ERP success. All these factors have been categorised based on the works of Sun *et al.,* (2005) as:

- Stakeholder Category (*Top Management Commitment (TMC), Project Champion (PC), Execution Team (ET), Qualified IT Staff (QITS), External Advisory Support (EAS), Vendor Partnership (VP) and Total End-User Involvement (TEUI*));

- Process Category (*Business Process Reengineering (BPR), Customisation Approach (CA) and Performance Measurement and Control (PMC)*);

- Technology Category (*IT Infrastructure (ITI), Package Requirements and Selection (PRS), System Testing (ST), System Quality (SQ) and Information Quality (IQ)*);

- Organisation Category (*Business and IT Legacy Systems (BITS), Change Management (CM), Effective Communication (EC), Business Vision Goals and Objectives (BVGO), Training and Education (TE) and Organisational Structure and Culture (OSC)*); and

- Project Category (*Project Management (PM), Budget – Cost Parameters (BCP) and Time (T)*).

These factor categories have frequently appeared in the literature denoting their significance in the context of ERP systems adoption and implementation. These factors are described as below under their respective factor category.

3.2.1.1 Stakeholder Category

Any change or improvement in the organisation needs co-operation from the organisational hierarchy and other internal and external stakeholders. This may include the support from top management for resources allocation, employees to plan and to design the system requirements, external advisors to provide expert advice, end users from various functional departments and vendor to provide the products and staff training. Stakeholder's management category is very crucial for new products adoption as there can be lot of resistance and organisational inertia in adopting new standards and work procedure into the existing culture of the organisation. Apart from preparing staff to accept the new system, other major element is to train them for using the new system. This becomes regular feature during the whole lifecycle and it has been noted by many researchers in the ERP literature. Importance of stakeholders as important success factors has been echoed in the literature by Somers and Nelson (2004), Ifinedo and Nahar (2007) and Dong *et al.,* (2009). Following are seven relevant stakeholder category sub-factors explained:

- **Top Management Commitment:** Top management commitment and support is a requirement for the successful ERP systems adoption and implementation in organisations (Wang and Chen, 2006; Upadhyay *et al.,* 2011). ERP systems implementation are costly, thus, require approval from top management board about allocating infrastructural, financial and human capital resources (Parr and Shanks, 2000). The top management's approval is usually based on business case appraisal of new projects and hence, would be the first step in the process of adoption, a top priority publicly and explicitly identified (Nah *et al.,* 2001). This makes top management commitment and support a crucial factor for ERP adoption and further implementation (Dawson and Owens, 2008). Holland and Light (1999) consider it as a strategic factor, Al-Mashari *et al.,* (2003, 2006) considers top management and leadership support in pre-implementation phase as a basic requirement of setting up the ERP adoption vision and planning. Advocates highly acknowledge the significance of top management support for successful ERP adoption and implementation (e.g. Chang *et al.*, 2008; Doom *et al.*, 2010). The latter argument is supported by (Maditinos *et al.*, 2012), who report that whilst working closely with the ERP users in successfully adopting and implementing ERP solution, significantly improves the interaction amid the business divisions and as a result, resolving any discrepancies becomes attainable. There are other researchers who also exemplify the importance of top management support (e.g. Somers and Nelson, 2001; Loh and Koh, 2004; Arnold, 2006; Ngai *et al.*, 2008). The latter researchers also accentuate a number of key components of top management support such as: project endorsement, acknowledging the significance of a project and giving it a top priority, top management involvement, defending and supporting the project, act as a go-between amid groups in times of disagreement, participating within the corporate strategy, comprehending ERP systems and its related issues, and appropriate allocation of resources to the project. *All the above-mentioned conceptions highlight that top management commitment may also influence ERP adoption and implementation in the context of SSOs.*

- **Project Champion:** Literature indicates that the foremost vital cause for the ERP adoption and implementation success/failure is the ability/inability of the organisations to consider the reformations in organisation, departments and development of individuals (i.e. human capital) in the context of ERP systems (Appleton, 1997; Muscatello and Chen, 2008). Most organisations have adopted the rationale of project champion has a good competitive advantage that will augment higher organisational performance. Project champion is a part of an overall effort to achieve cost-effective and organisational performance (Dawson and Owens, 2008). Hence, organisations need to understand the importance of project champion that can also increase employee satisfaction and enhance organisational performance. The vital means to administer the project champion are training for technical skills (Hill, 1997), financial resources, approach of applying ERP, pacing the time of implementation and matching the suitability of the project team and project needs (Muscatello *et al.*, 2003). In ERP projects there is always a vital need for a high level executive that has experience, expertise and influence to establish goals and manage the transformation phase. For example, this can be in the form of project champion who understands the overall system's benefits and can promote them to the rest of the organisation (Parr and Shanks, 2000; Nah *et al.*, 2001). Thus, *based on the above-mentioned conceptions it can be said that project champion may play a critical role in the success of ERP adoption and implementation in the context of SSOs.*

- **Execution Team:** In an organisational context, the execution team (involved in the implementation of ERP systems) and its make-up is important to the success of ERP implementation, given that the skills and knowledge of personnel involved in the executive team are critical to the ERP systems. Forming cross operational team including departments, line managers, vendor executives and consultants is also essential for the technical skills in design, installation and operations. The team members should be from technical and business process function backgrounds and possess relevant knowledge, as ERP should be aligned to organisational processes and requirements (Nah *et al.*, 2001; Dawson and Ovens, 2008). The execution team building criteria may include knowledge, experience, cross-functionality, decision making, business understanding, team dynamics and time availability (Holland and Light, 1999; Nah *et al.,* 2003). This is because the execution team would be answerable and liable for any/all success or failure of ERP implementation and therefore, would be considered as one of critical factors in the context of this research. It is noted that an ERP project includes all functional areas of an enterprise. Thus, the earlier argument becomes vital i.e. the endeavours and support of technical and business specialists and end-users is necessary for the success of an ERP implementation and involving individuals with both business and technical knowledge into the project is essential for success (Nah and Delgado, 2006). Somers and Nelson (2001) emphasize on the importance of execution team competence. Nah *et al.,* (2001) support the latter on the importance of good collaboration between project team members, whereas Chang *et al.,* (2008) emphasize the necessity of collaboration between different departments and parties involved. Thus, *all the above-mentioned conceptions highlight the importance of execution team and may also influence ERP adoption and implementation in the context of SSOs.*

- **Qualified IT Staff:** Literature highlights that the quality of staff that support in the implementation of information systems along with their senior executives is considered highly significant. For example, the project manager is also a staff member of the organisations and should have both technical and business knowledge, and the capability to communicate with senior management. Qualified support staff must be experienced and clever enough to interact with top management and be able to master the technologies required for the system (Poon and Wagner, 2001). The ease of use and access of adequate equipment in the organisation is a major determinant of adoption of new technologies. Kamal (2008) also highlights that the available skill set of the personnel is an important factor that may constraint the introduction of new technologies and information systems in the organisation. Perry and Danziger (1980) also report that staff competence is considered as important factor whilst adopting IT applications. In public organisations, managements argued that their employees were not very well trained in using IT and this insufficient training resulted in resistance to change, and under utilisation of IT solutions (Norris, 1999). Finally, technological sophistication evaluates the level of management understanding and support for utilising IT to accomplish organisational purpose (Chwelos *et al.*, 2001). Thus, *based on the above-mentioned conceptions it can be said that the higher levels of IT capabilities in staff may influence ERP adoption and implementation in the context of SSOs.*

- **External Advisory Support:** Organisations from both private and public sector frequently use consulting support and expert advice from external advisors for requirements analysis, planning, design, implementation and installation of ERP systems. This enables the organisations and teams involved in the ERP implementation process to authenticate their adoption and implementation of ERP systems from external expertise (Garcia-Sanchez and Perez-Bernal, 2007). Secondly, this process of consulting with external advisors will enable the organisations to bring in skills and experience that they are lacking within the organisation with the support of external advisors. According to Somers and Nelson (2004) consultants and or advisors can offer expert suggestions during any stage of the process of enhancement or solving a problem but their role may become less frequent with time as project team and end users would get the required skills and training. Researchers highly acknowledge that ERP implementation is a complex process, thus, it requires use of experts and consultants external to the organisation, those that have experience in instating the software in the existing organisational infrastructure. Researchers such as Somers and Nelson (2004) and Xiang (2007) report that during the ERP implementation process, the external experts and consultants may participate in different individual stages. The latter arguments are supported by Upadhyay *et al.*, (2011), who accentuate that the utilisation of an external expert or a consultant relies on internal operational and functional awareness that the organisation has at the beginning of the ERP project. McLachlin (1999) also supports the latter arguments and state that to accomplish high-level interaction with customers and deal with their possible emerging disagreements, an external expert or a consultant sought to possess the appropriate skills and knowledge. These latter conceptions are supported by Wang and Chen (2006), who highlight that the outcomes that an external expert offer whilst or following the configuration of ERP systems candidly impact on the efficiency and efficacy of ERP system implemented. Maditinos *et al.*, (2012) endorses the latter argument by stating that successful relocation of knowledge and experience to the adopting organisation is highly dependent on the extensive knowledge and support from the external expert and consultant. Thus, *based on the above-mentioned conceptions it can be said that external advisory support may also influence ERP adoption and implementation in the context of SSOs.*

- **Vendor Partnership:** Researchers accentuate that vendor selection and partnership development with vendors is crucial. This is because vendors are more knowledgeable and possess much information with regards to the system being supplied. Moreover, it is their undertaking to offer a variety of alternatives to organisations on the customisation, features, time and cost saving techniques and operational training – all with regards to ERP systems (Somers and Nelson, 2004). The latter arguments are supported by Butler (1999), who also reports that the association amid organisations and vendors should be strategic in nature, as vendors' expertise and technical skills can most likely increase an organisation's performance, efficiency and competitiveness. Remus (2007) also reports that the vendor partnership is essential before ERP systems implementation where vendor support is crucial post-implementation. Vendor partnerships with organisations may prolong throughout the ERP systems lifecycle including its advanced application versions' installation. Vendors support several organisational activities e.g. including among others are in technical assistance, training to end user employees, emergency maintenance and updates (Somers and Nelson, 2001; Remus, 2007). This functionality of vendor makes vendor partnership a critical success factor. It is also reported that vendor's workforce are sought to be knowledgeable and informed in relation to both the organisation's business processes and the overall organisation-wide system functions. According to Zhang *et al.*, (2002) organisations need to be cautious in opting for vendors. This is because vendors' support is vital in formulating the resulting product i.e. the ERP systems implementation. These theorised conjectures accentuate that a project's success is found to be positively related with the appropriateness and harmonisation with IT vendor partnered (Kansal, 2007; Upadhyay *et al.*, 2011). Thus, *based on the above-mentioned conceptions it* *can be said that vendor partnership may also influence ERP adoption and implementation in the context of SSOs.*

- **End User Involvement:** ERP systems are implemented by project teams but the system itself brings an organisation-wide change that for many is a positive change towards overall organisational quality performance. End users of the system are spread throughout the organisation and thus, their involvement is very much essential to map their skills and exact departmental requirement while adopting and finalising the ERP systems. According to Remus (2007) there are two types of end users – pre-implementation and post-implementation end users. Pre-implementation end users are essential at the requirements analysis, planning and training phases, whereas, post-implementation end users involvement is vital for acceptance and cascading the usage of the system. Upadhyay *et al.,* (2011) also exemplify that user involvement and participation signify the attitudes and operational activities that end users carry out in the system process. The latter illustrates an emotional condition of the individual and is described as the significance and individual bearing of a system to a user. According to Kansal (2007), when an organisation attempts to adopt and implement an enterprise information system, there are two key domains of user participation. *Firstly*, user involvement in stage of definition of organisation's enterprise system needs and, *secondly*, user participation in implementation of enterprise systems. Researchers such as Levy and Powell (2000) and Upadhyay *et al.,* (2011) report that lack of experience and knowledge in IT, usually leads to limited user participation. In order to positively influence users' viewpoints in relation to new technological solutions, the actual advantages of deploying ERP system sought to be constantly repeated (Umble *et al.,* 2003). Or else, users are not stimulated to extend their support for implementing ERP systems and not eager to assist the experts and or the consultants and incorporate the skills and knowledge transferred to the users (Wang and Chen, 2006; Maditinos *et al.,* 2012). Thus, *based on the above-mentioned conceptions it can be said that end user involvement may also influence ERP adoption and implementation in the context of SSOs.*

3.2.1.2 Process Category

ERP is not only adopted for improving specific functions but it integrates business functions and allows management to exercise the organisation wide control over main business process, organisation's performance and customisation of functional processes (Sun *et al.,* 2005). ERP is utilised as a suite of application modules that can link operations between front and back offices (Verville *et al.,* 2005), can integrate several business functions (Wu and Wang, 2006). The process category has appeared in the literature from research of as many as 16 authors (e.g. with some mentioned here: Loh and Koh, 2004; Muscatello and Chen, 2008; Dezdar and Sulaiman, 2009). Following are three relevant process category sub-factors explained:

- **Business Process Reengineering:** In this step, the project manager in discussion with the vital team members ascertains the formalised procedures in which system will work, not in technical terms, but in terms of the processes the organisation utilises to achieve different tasks, and the way a business will operate after the ERP system package is in use (Al-Mudimigh *et al.,* 2001). The business process modelling is a comprehensive narrative illustrating the way an organisation implements ERP systems in order to back their business operational activities. BPR is actually a design manuscript that has vital role in the following steps e.g. the configuring the ERP system (Appelrath and Ritter, 2000; Al-Mudimigh *et al.,* 2001). In the ERP systems configuration process, a significant percentage of reengineering takes place iteratively – the essence herein is to acquire the benefit of the benchmarks provided by ERP system. In this perspective, where and when possible, organisations sought to be prepared to recognise the entrenched benchmarks and model their core business processes derived from those exemplified by the system. According to Nah *et al.,* (2003), as soon as the ERP system is up and running, organisation should focus to continue with reengineering with better ideas and updates in order to completely benefit from ERP system's potential. Murray and Coffin (2001) also denote that organisations ought to be prepared to transform their core businesses to be compatible with the software and reducing the scale of customisation required. Other researchers argue that software ought to be modestly personalised (e.g. Nah *et al.,* 2003), in order to reduce the chances of inaccuracies and take benefit from recent most software editions (Rosario, 2000). The latter conceptions highlight that ERP can be considered as an exclusive instance of IT adoption and implementation, where business process transformations are vastly significant to the outcomes of its adoption and implementation. The latter discussions clearly highlight the significance of business process change in relation to ERP adoption and implementation, it would also be vital to understand a pragmatic insight into this association. On the other hand, Law and Ngai (2007) assert that it can be of benefit to provide an understanding the methods organisations aspire to adopt for establishing business process changes in relation to ERP adoption and implementation. Thus, *based on the above-mentioned conceptions it can be said that business process reengineering may also influence ERP adoption and implementation in the context of SSOs.*

- **Customisation Approach:** Customisation of software at the later stage is not an error free undertaking. Holland *et al.,* (1999) asserts that organisations ought to be prepared to transform their individual businesses in order to fit the software with nominal customisation. However, Sumner (1999) argues that it is better not to modify the software as much as possible. Alterations to the software should be eluded as much as possible to diminish errors and to take advantage of newer versions of the software (Rosario, 2000). There are a number of process modelling tools that support the organisations in customising business processes without the need to change large amounts of software code (Holland *et al.,* 1999; Nah *at el.,* 2001). Accepting or rejecting the suppositions regarding business processes fabricated within the system takes place earlier in the implementation process and more importantly, impacts the scale of customisation required to the software and or the organisations itself (Somers and Nelson, 2004). Other researchers also argue that nominal customisation leads to successful ERP implementation, this is because increased amount of customisation leads to higher costs, lengthy implementation time, and lack in gaining software maintenance benefits and updates (Raymond *et al.,* 2006; Raymond and Uwizeyemungu, 2007). Organisations may or may not require customisation, but if so, it certainly incurs costs and time (Upadhyay *et al.,* 2011). Thus, *based on the above-mentioned conceptions it can be said that customisation approach may also influence ERP adoption and implementation in the context of SSOs.*

- **Performance Measurement and Control:** It is highly acknowledged that performance measures that evaluate the effect of the new system(s) must be cautiously structured. Certainly, the measures are required to point towards how the system is performing. Conversely, the measures must also be designed in an attempt to support the considered necessary activities by all operations and individuals. Umble *et al.,* (2003) reported that such measure may encompass timely deliveries, gross profit margin, customer order-to-ship time, inventory turns, and vendor performance. It is vital to incorporate the project evaluation measures at the start. If system implementation is not connected with reimbursement, it cannot be guaranteed to be successful. Managements at all levels, vendors and their team, the project implementation workforce, and the users ought to share a clear comprehension of the organisational aim. Reallocation or assistance should be provided to those who are incapable of achieving agreed-upon objectives. In achieving the desired results, teams should be rewarded. It is the responsibility of the management to closely scrutinise the system implementation until it is completed (Rosario, 2000; Murray and Coffin, 2001; Umble *et al.,* 2003). These latter conjectures indicate that the addition of an array of effectual and quantifiable project goals to scrutinise and assess the performance of ERP implementation alongside business requirements ought to be contemplated throughout (Loh and Koh, 2004). Thus, *based on the above-mentioned conceptions it can be said that performance measurement and control may also influence ERP adoption and implementation in the context of SSOs.*

3.2.1.3 Technology Category

The basic function of ERP systems is to provide organisations with the opportunity to integrate functions and individuals information crating a data discipline. It uses large number of activities and data associated with it into one integrated information system (Trimmer *et al.*, 2002). ERP has become the fastest growing technology product that allows creating competitive advantages in terms of operational and technical excellence. Technology category provides organisation a single view of their data and operations associated with it (Davenport, 1998). The advent of technological developments in terms of database management systems from Oracle, IBM and Microsoft and ERP models from Peoplesoft, Baan and Oracle have proved as motivating drivers for usage of ERP as technical system. Technical usage of ERP is infused by many factors such as existing disparate systems, poor quality of information, not integrated systems, obsolete systems, systems not supporting growth (Trimmer *et al.*, 2002). King and Burgess (2006) refer to ERP as a technology and its implementation can be defined as IS innovation process. Following are five relevant technology category sub-factors explained:

- **IT Infrastructure:** IT infrastructure is a vital part of the overall infrastructure of an organisation that develops a platform for the IT/IS (Shaw, 2000; Kamal, 2008). IT infrastructure includes computer systems and relevant supporting software required to develop, manage and operate IT applications, e.g. operating systems, database management systems, development tools and management tools (King and Burgess, 2006; Kamal, 2008). Thus, sufficient amount of hardware and networking infrastructure are required for ERP systems implementation. An ERP system depends in its operation on high-level IT infrastructure. Additionally to the infrastructure, evidently, the software configuration has a significant impact on the implementation process and conclusion (Jarrar *et al.*, 2000). IT infrastructure and human resource development both have limited influence on ERP implementation. Even though the necessary IT infrastructure required to back the ERP system is to a great extent required, the individual endeavour should not be directed at selecting the IT infrastructure. In order to enhance the likelihood of ERP implementation success, organisations need to start viewing ERP as a holistic business undertaking, rather than merely a large scale IT project. Ehie and Madsen (2005) asserts that the significance ought to be positioned on ERP offer a business solution and not essentially an IT solution. Others including Ross *et al.,* (2006) and Doom *et al.,* (2010) consider standardisation in IT infrastructure to be an important success factor for all technological implementations. Thus, *based on the above-mentioned conceptions it can be said that an appropriate fit of ERP within an IT infrastructure may also influence ERP adoption and implementation in the context of SSOs.*

- **Package Requirements and Selection:** ERP is considered as a packaged set of applications (Themistocleous, 2004). ERP vendors assert that their systems/applications are intersecting in functionality but in actual it is not the case, at least not in full. For example, some packages are more suitable for larger and multinational organisations, some more appropriate for smaller organisations and SMEs. Once it is decided to select an appropriate package then it is time to decide to select a suitable version or module of the package that would best suit the organisational needs and requirements. Akkermans and Helden (2002) argue here that if the selection process goes incorrect at this stage, the organisation either confronts eccentric between package and their organisational business processes and strategy, or a need for most important modification to the software, which is extremely time-consuming, costly and risky. It can said that the selection of the appropriate package throughout the initiation and adoption stages entails vital decisions with regards to budgets, goals, time-frames and delivering tasks that will shape the whole project. According to Somers and Nelson (2004) and Remus (2007) the greater the effort entailed in selecting ERP packages, the greater the chance of overall success. Generally, an organisation opts for a package that is on the whole comprehensible, has sufficient capacity for scalability and deals with a series of business processes in situations when organisations are faced with issues – all this needs cautious concentration (Kraemmergaard and Rose, 2002; Al-Mashari, 2002; Somers and Nelson, 2004; Upadhyay *et al.,* 2011). Thus, *based on the above-mentioned conceptions it can be said that package requirements and selection may also influence ERP adoption and implementation in the context of SSOs.*

- **System Testing:** According to Nah *et al.,* (2003), the development and testing stages of an ERP project ought to be cautiously designed and managed. They also accentuate that the entire ERP infrastructure ought to be developed prior to the reaching the employment stage, having in mind the core needs of the implementation stage. Herein, Loh and Koh, (2004) reports that in so doing will avert reorganisation at each sub-stage of the implementation stage. The exploitation of suitable modelling approaches, architectures and tools will assist in accomplishing ERP success (Scheer and Habermann, 2000; Murray and Coffin, 2001). According to Rosario (2000), thorough and sophisticated software testing simplifies the implementation process. In doing so, the organisations involved in ERP implementation process ought to operate in conjunction with their vendor partners, experts and consultants to solve any emerging issues in the implementation process. It is evident that system testing has established itself to be the most vital aspect of success and a direct source of malfunction (Nah *et al.*, 2003). Literature highlights a number of examples on system testing, for instance, the Gillette Company carried on for five months to perform their arduous testing process prior to moving onto the Go-Live stage (CIO, 2000), whereas, Eastman Kodak finally ended their largest ever implementation process, whilst accrediting the testing stage as the most important factor for their successful implementation (Gargeya and Brady, 2005). Thus, *based on the above-mentioned conceptions it can be said that systems testing may also influence ERP adoption and implementation in the context of SSOs.*

- **System Quality:** This signifies the functioning and performance related features of ERP systems. Ifinedo and Nahar (2007) report that system quality is related to problems concerning the facilitation of exploiting and getting knowledge of the system, reliability, its data correctness, stability and effectiveness. In the context of IS discipline, IS quality is considered to have a wider viewpoint as compared to other rationales illustrated within the IT sector e.g. software quality as reported by Andersson and von Hellens, 1997). An alternative interesting perspective is that researchers have broadly focused on the technical features whilst concentrating on the system quality problems (Dahlberg and Järvinen, 1997). ERP system is an integrated system that by nature is also considered as one-system-only information and knowledge system. Rosemann and Wiese (1999) report that ERP systems model all the business process in a single system and the administration of the latter is vital for success of organisations. This is manifestly a phenomenon as information technology and its exploitation by employing IS are factors that result in accomplishing competitive edge (Earl, 1990). Thus, *based on the above-mentioned conceptions it can be said that systems quality may also influence ERP adoption and implementation in the context of SSOs.*

- **Information Quality:** This factor focuses on quality of information extracted from the information systems. Information quality is reported to be of two types i.e. *inherent* quality (i.e. is the exactness or accuracy of data) and *pragmatic* quality (i.e. is the value that precise data has in backing the work of the organisation). Information or data that does not facilitate the organisation in accomplishing its overall vision cannot claim to have no quality, after that it does not matter how précis the data is. Researchers report that information quality is concerned with the relevance, understandability, accessibility and the usability of information productivity of the system (Ifinedo and Nahar, 2007). In the context of ERP systems, information quality is about the information generated by the ERP system. Laberis (1999) reports that ERP system's prime significance is its capability to restructure the information flow in the organisation. Thus, *based on the above-mentioned conceptions it can be said that information quality may also influence ERP adoption and implementation in the context of SSOs.*

3.2.1.4 Organisational Category

Selection of ERP system is largely affected by what organisations aspire to achieve and what resources they have to carry out this. Need analysis for internal improvements in congruence with gap analysis for 'market fit' lay the foundation for selection, adoption and design of the information system, e.g. like ERP systems. Hence, the appropriate fit between needs of a firm and the features or modules available in the ERP system becomes crucial. Hong and Kim (2002) found in their study that ERP implementation success significantly depends on the 'organisational fit' of ERP and few contingencies during the implementation. According to the organisational fit perspective factors such as firm's resources, project team's skill set and requirements of the organisation become critical success factors. Alignment between IT strategy and business strategy plays very vital role into ERP implementation. Following are six relevant organisational category sub-factors explained:

- **Business and IT Legacy Systems:** Legacy systems in an organisational infrastructure encompass IT infrastructure including the software and hardware, all organisational business processes, and overall business organisation culture and structure (Dawson and Owens 2008; Doom *et al.,* 2010). According to Holland and Light (1999), when organisations plan to implement ERP systems, they initially need to cautiously describe and assess the existing legacy systems in order to realise the scale and nature of issues that the organisation may confront with whilst the ERP implementation process. Rao (2000) also asserts that it is vital that sufficient infrastructure is sought to be contemplated so that it can be accessible on time, whereas, Holland and Light (1999) emphasize the requirement to cautiously administer existing legacy systems whilst implementing ERP systems. Researchers accentuate and recommend that when organisational existing legacy systems turn to be intricate, then the scale of organisational and technical changes needed is expected to be high (Holland and Light, 1999; Rao, 2000). Researchers also report other issues with existing legacy systems e.g. issues of data inconsistency and repository such that data is not stored in a sole repository but instead it is distributed across a range of incongruent information systems, with each IS using a different operation system, and housed in a separate operation. Davenport (1998) highlighted that it may be possible that these legacy systems may offer constructive backing in relation to specific organisational tasks, but when employed in a grouping, issues start emerging that inhibit organisational performance and productivity. Al-Mashari *et al.,* (2003) also highlight the significance by stating that business organisations carefully reach the transition stage of legacy systems with a thorough plan. According to Dawson and Owens (2008) and Doom *et al.,* (2010), existing business organisation legacy systems realise the IT and organisational transformation needed for success. Thus, *based on the above-mentioned conceptions it can be said that appropriate business and IT legacy systems may also influence ERP adoption and implementation in the context of SSOs.*

- **Change Management:** Implementing the ERP or new system is part of the corporate restructuring or business process re-alignment. In such cases, ERP adoption and implementation is considered as project of change management and project is managed in the form of a change or incremental transformation. Managing organisational inertia for accepting change and related conflicts is the first priority of top management in this type of business scenario (Al-Mudimigh *et al.,* 2001). Activities, processes and methodologies which can support employees' issues regarding change and ERP implementation are given priority (Cooke and Peterson, 1998). Structures and processes of the companies before change may not be compatible with intended change or improvement through ERP. In these types of cases, it is advantageous to adopt ERP implementation as a change management process (Umble *et al.,* 2003; Woo, 2007). The latter indicates that distinguishing the requirement for change to continue to stay competitive is highly essential. Several researchers accentuate that it is important to administer and handle the transformations taking place whilst ERP implementation (Somers and Nelson, 2001; Nah *et al.,* 2001; Umble *et al.,* 2003; Nah *et al.,* 2003; Ngai *et al.,* 2008). It is also reported that change management is vital and major apprehensions of IT implementation projects (Somers and Nelson, 2004). The persistent improvisational modification method is a valuable modus operandi for ascertaining, administering and training modification in ERP implementing projects (Upadhyay *et al.*, 2011). Thus, *based on the above-mentioned conceptions it can be said that change management may also influence ERP adoption and implementation in the context of SSOs.*

- **Effective Communication:** In daily organisational operational activities, effective communication is a key to achieving common objectives and organisational success. There are two types of communications – open horizontal (i.e. effective interaction amid users and different departments) and open vertical (i.e. interaction medium amid employees and top management) communication (Dawson and Owens, 2008). In the 1980s Koontz *et al.*, (1980) defined effective communication as "the transfer of information from the sender to the receiver with the information being understood by the receiver". Since then research and practitioners community have recognised the significance of effective communication in the business organisations. Luarn *et al.*, (2005) also report that effective communication has received global recognition amid managements and leadership. For example, according to a study conducted by Kumar *et al.*, (2003), 25% of business organisations adopting and implementing ERP systems have inevitably encountered resistance from employees, whereas, 10% faced opposition from the management. Loh and Koh (2004) argue in the latter case, that effective communication is vital for ERP successful implementation. According to Nah *et al.*, (2001) and Dawson and Owens (2008), effective communication ought to be diffused within the all major and minor levels in the organisation and everybody in the organisations is sought to realise in the case of business process transformation. Thus, *based on the above-mentioned conceptions it can be said that effective communication may also influence ERP adoption and implementation in the context of SSOs.*

- **Business Vision Goals and Objectives:** Business vision, goals and objectives clearly indicate the overall setup of the organisation. Buckhout *et al.*, (1999) reported that a comprehensible business organisation plan and vision to guide the project in the appropriate direction is required all through the ERP lifecycle i.e. from adoption to implementation to final acceptance and usage. The latter is supported by Loh and Koh (2004) who state that an appropriate business plan (with clear business vision, defined goals and objectives) that delineates the projected tactical and substantial advantages, costs, resources and risk and timeline are all essential. Nah and Delgado, (2006) argue in the context of latter conception that in doing so will support in maintaining the focus on organisational business benefits. Therefore, it is quite comprehensible that is very essential to have in place apparent business vision, goals, and objectives for ERP implementation projects (Doom *et al.,* 2010). Upadhyay *et al.,* (2011) also reports that for ERP projects, the vision and mission ought to clearly indicate the quantifiable goals and targets – goals and targets that need to be apparent and comprehensible. Thus, *based on the above-mentioned conceptions it can be said that business vision goals and objectives may also influence ERP adoption and implementation in the context of SSOs.*

- **Training and Education:** Researchers highly acknowledge the significance of training and education in an organisational context and have also reported to be a critical success factor with regards to ERP projects (Davenport, 2000; Woo, 2007). Davenport (2000) report that ERP implementation needs a critical mass of information to facilitate individuals in order to solve issues within the model of the system. Moreover, to take full advantage of the training and education process, managements need to focus on commencing the training process at the early stage of the ERP projects, if at all possible well prior to the implementation stage (Muscatello and Chen, 2008). However, there have been cases where leadership has radically misjudged the intensity of education and training essential for ERP implementation projects and their related costs (Umble *et al.,* 2003). Nevertheless, Upadhyay *et al.,* (2011) argue that leadership and top management ought to be totally enthusiastic and devoted to invest huge amounts of money, time and other related resources on workforce training and education and integrate this as a component of the ERP budget. Upadhyay *et al.,* (2011) also reported that allocating between 10 – 15 % of entire ERP adoption and implementation budget for training and education offers the organisation with an 80 % possibility of success in ERP implementation. Thus, *based on the above-mentioned conceptions it can be said that training and education may also influence ERP adoption and implementation in the context of SSOs.*

- **Organisational Structure and Culture:** Researchers have highlighted the importance of organisational structure and culture, e.g. Collins (2001) and Remus (2007) report that in order for employees to work collaboratively, organisations need to comprehend and recognise the significance of their structure and culture. This organisational cultural concept incorporates collaborative experience, principles, and attitudinal standards (Skok and Legge, 2002). Johnson and Scholes (2005) report that an organisational structure and culture that focuses on advertising learning and modernism can be particularly significant to the overall success or malfunction of the IT innovation and or strategy in the organisation. The latter is supported by Scott and Vessey (2000) who provide case study based evidence that organisational structure and culture are highly influential and impact the success or failure of ERP implementation process. On the other hand, Edwards and Panagiotidis (2000) also support the suggestion that organisational structure and culture are valuable in comprehending successful ERP implementations. For this purpose, Edwards and Panagiotidis (2000) have also put forward a Business Systems Purpose Analysis (BSPA) methodology and suggested its incorporation into SAP's ASAP implementation methodology. Nah *et al.,* (2007) argues that organisational culture should promote sincerity in interaction throughout the organisation including facilitating the learning process; otherwise, employees will either resist or act in a negative attitude towards ERP implementation, leading towards failure. Thus, *based on the above-mentioned conceptions it can be said that organisational structure and culture may also influence ERP adoption and implementation in the context of SSOs.*

3.2.1.5 Project Category

The fundamental role of any information system is to support the business operations, managerial decision making and create a competitive advantage through tangible benefits. Thus, any system before final adoption decision passes through the feasibility and appraisal as a project (O'Brien and Marakas, 2007). This analysis focuses on ERP as a project success with conditional constraints of usual project management in terms of 'time, budget and quality' - the Iron triangle of projects management (Dezdar and Sulaiman, 2009). Following are three relevant project category sub-factors explained:

- **Project Management:** It is highly cited fact that ERP implementation is challenging, uncertain and most importantly, expensive. Bancroft *et al* (1998) recommended that ERP implementation is intricate, needing a grouping of business, technological, and change management proficiencies. However, to avoid any failures and achieve the desired benefits and gain, project managers need to cautiously manage and monitor the whole ERP implementation process (Nah *et al.,* 2003; King and Burgesss 2006). This signifies the importance of project management, if not vital for success and project managers sought to be skilful in both strategic and tactical project management roles to successfully implement the project. According to Appelrath and Ritter (2000), project management is about planning, organisation, IS acquirement, appropriate workforce selection, administration and scrutinisation of system implementation. Peak (2000) on the other hand, stressed that in order to deliver quality products, project management is essential. In this regard, researchers argued that due to the high impact of ERP systems, the individuals working as part of the project team should either be from the management or be in a administrative role and more importantly, and be involved in making decisions (Bancroft *et al.*, 1998; Al-Mudimigh *et al.*, 2001; Nah *et al.*, 2003; Somers and Nelson 2004). Thus, *based on the above-mentioned conceptions it can be said that project management may also influence ERP adoption and implementation in the context of SSOs.*

- **Budget – Cost Parameters:** Budgets and costs are vital for any IT project implementation (Upadhyay *et al.*, 2011). With regards to ERP system implementation, its cost highly depends on the size of the functions and extent of its execution. According to Rogers (2002), where SMEs are involved, the costs can be from $15,000 annually for a site licence for around 15 end-users. Whereas, Koch (2002) reported that the typical total cost of ownership in relatively larger organisations can be around $15 million, on the other hand, for multinational or even large organisations, the total cost of ownership could go beyond $300 million. In the context of ERP systems implementation, the total cost of ownership is more than just the actual cost of the software (Upadhyay *et al.*, 2011). Other ERP expenditures comprise of the alterations and adjustments required during ERP systems implementation, and more importantly, the prospective expenditure with regards to waiting time for realising the return on investment. An additional innate expenditure related to ERP systems is the upgrading cost; this is because usually implemented and installed systems need new functions every now and them to remain effective and efficient (Dowlatshahi, 2005). According to Koch (2002), the upgrading is usually around 30% of the original ERP software budget. Thus, *based on the above-mentioned conceptions it can be said that budget-cost parameters may also influence ERP adoption and implementation in the context of SSOs.*

- **Time:** Time is crucial for the success of many of IT/IS implementation projects. Dowlatshahi (2005) highlighted that the amount of time need to appropriately execute an ERP system eventually differs based on the requirements of the end-users. Several leading ERP vendors assert that ERP systems implementation can be finished around 3 to 6 months time, however, this merely involves the setting up of infrastructure and software applications, but for some the reality is that ERP implementation takes around 2 years time (Dowlatshahi, 2005). This amount of time is typically needed for employee training and conclusion of data alteration in order for all approved users to access the data via the ERP system (Koch, 2002). A number of organisations do not prefer to conduct and ROI analysis e.g. some organisations assert that their purpose of implementing ERP systems is not to gain profits but to improve their operations. Stein (1999) reports that in case of the latter conception, it is wise to put this forward to the investors because most of ERP systems exhibit no positive signs on ROI for around 5 years of services. Dowlatshahi (2005) however, asserts that organisations can expect to receive steady form of return on their investment; nevertheless, not in the conventional mode of earning. Thus, *based on the above-mentioned conceptions it can be said that time may also influence ERP adoption and implementation in the context of SSOs.*

In this section, the author proposed and discussed factors that may influence ERP adoption and implementation in the context of SSOs. The author presents some reasons for proposing these factors that are listed below:

- The adoption and implementation of ERP in SSOs.
- Limitations in the literature highlight the absence of theoretical models for ERP adoption and implementation in SSOs.
- The above discussed intricacy and restrictions of current SSO IT infrastructures have resulted in a number of issues. ERP systems have shown the potential of being integrated solution that support organisations in bridging their applications in concert. To speed up the decision-making process for adopting and implementing ERP in SSOs, the above explained influential factors may assist the SSO decision makers in understanding and fully comprehending ERP system and its implementation process.

Figure 3.2 exhibits the proposed factors influencing ERP adoption and implementation in SSOs and categorises the factors as identified in Sections 3.2.1.1, 3.2.1.2, 3.2.1.3, 3.2.1.4 and 3.2.1.5 into: *(a)* stakeholder, *(b)* process, *(c)* technology, *(d)* organisational, and *(e)* project factors.

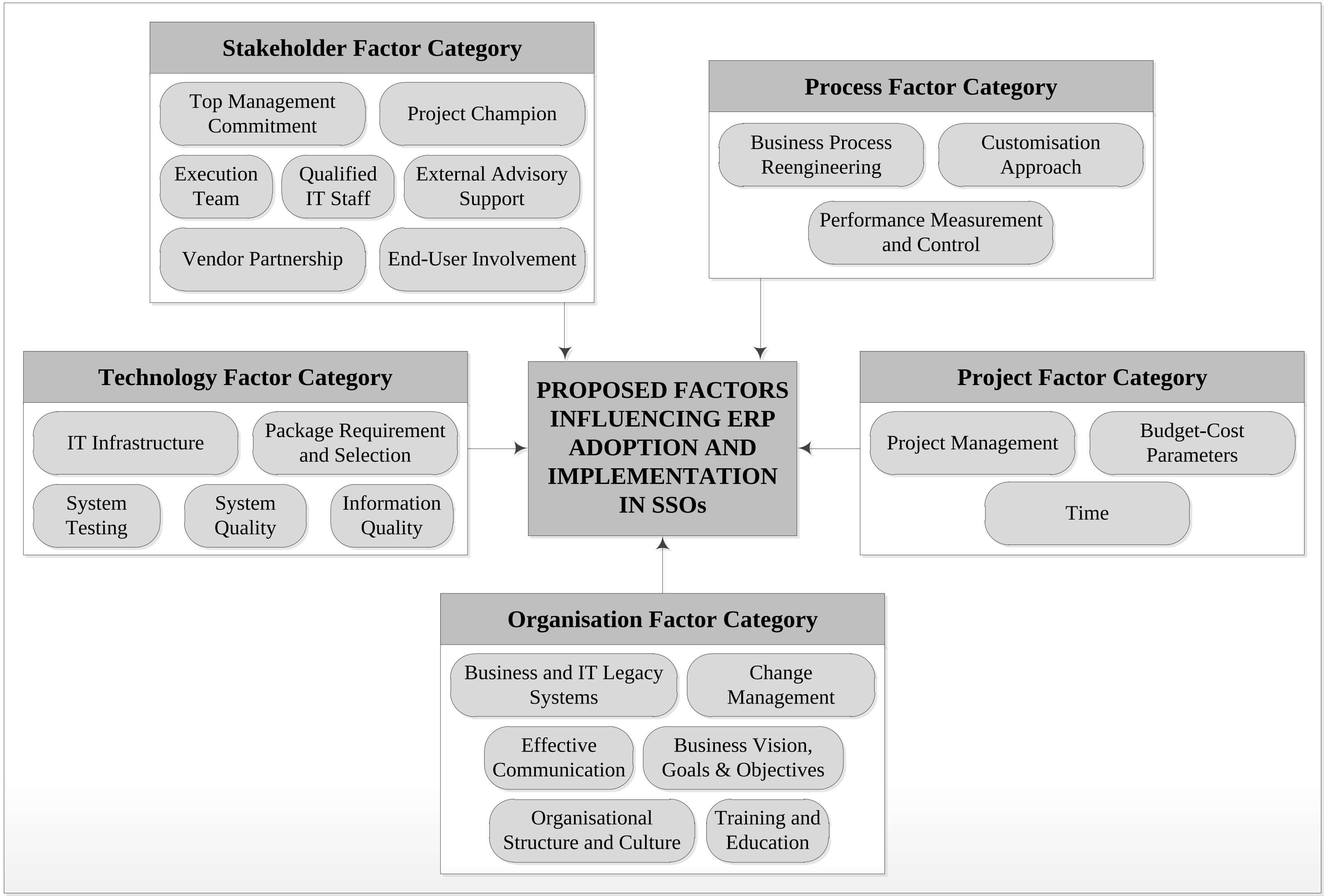

Figure 3.2: Proposed Factors for ERP Adoption and Implementation in SSOs

The author asserts that the above proposed factors contributed at the conceptual level. These factors are a mixture of factors investigated from the extant ERP adoption and implementation research studies, with other particular factors noted and reported from the specific SSO literature. The author takes into consideration the existing works and factors and adapts them in the context of ERP adoption and implementation in SSOs. This has resulted in the development of five major categories of factors with sub factors influencing ERP adoption and implementation in SSOs. However, the author states that the proposed factors are still to be evaluated in the context of SSOs. Therefore, the author recommends that whilst adopting and implementing ERP systems in the context of SSOs, understanding the factors influencing the decision-making process for ERP adoption and implementation in SSOs may offer a profound comprehension on ERP adoption and implementation process. Hence, the proposed factors may be deemed necessary whilst ERP systems are initiated in SSOs. In that way, the proposed factors may: *(a)* widen the extant research on ERP adoption and implementation, *(b)* improve the level of ERP adoption and implementation investigation and *(c)* support SSO decision makers to adopt and implement ERP systems. As a result, based on the aforementioned research the author proposes the following research proposition for further investigation in this thesis:

> ***Research Proposition 1 – Proposed ERP Adoption and Implementation Factors:*** *The proposed factors (Figure 3.2) can influence the decision making process for ERP adoption and implementation in the service sector organisations.*

3.2.2 Prioritising the Importance of Factors Influencing ERP Adoption and Implementation

In this section the author concentrates on the theory development i.e. investigating the prioritisation of factors influencing ERP adoption and implementation in SSOs by employing AHP technique, as a supportive tool. There are a number of viewpoints on the prioritisation of factors theorised in the literature, nevertheless, a communal interpretation can be deemed as the process of ranking factors based on their importance and thus, supporting in the decision-making process (Huang *et al.*, 2004; Lam and Chin, 2005; Salmeron and Herrero, 2005). In relation to decision-making in SSOs, a number of IT projects entail distributed decision-making based on a partition of authority and supremacy, as compared to other private sector organisation that have exclusive power over decisions in the organisation. With regards to making ERP implementation successful, project managers and top management come across many trade off in the decision-making. Many times the decision-making requires immediate changes in the business process, functions, operational and communication structures. The balance between change applied, risk taking and structural control can influence the outcome of ERP implementation at every such decision-making scenario. This makes each factor which can influence this decision-making, a critical one for the success of ERP. When such factors are overlooked and decision-making is affected, it increases the chances of ERP failures and loss of investments resulting into organisation wide impacts.

IT projects usually have more emphasis on technological part and many times representatives from non-IT departments are missing. The latter proves very crucial during the later stages of implementation process when roll out needs project managers who know more about the organisation, its structure and business process rather than only software or hardware components of ERP. Since, large ERP installation can bring overall changes in the organisation, it has become much necessary from earlier experiences that IT projects like ERP implementation consists of team members from all end users departments. ERP has increasingly become a business process or a business intelligence solution which can integrate earlier isolated functions and processes in the organisation to create more leverage in using resources and adding value that can result into overall performance enhancement. With number of researchers proposing so many CSFs, it is evident that these factors cannot be address at the same time and all factors cannot be relevant to each context of ERP implementation. Several studies have noted that ERP implementation is a risky project even when chosen to implement in phased or incremental time line and not a big bang approach.

From a technical perspective, ERP projects have many significant differences comparing to other IT projects. The rationale for using ERP is not to build a system from scratch but to piece together multiple incompatible and in many cases heterogeneous applications (Lam, 2005; Themistocleous and Irani, 2006). Thus, the emphasis is on the piecing together existing systems with new systems. ERP projects bring a chain of organisational changes in terms of structure, control (e.g. process control) and workflow. These changes are deeper comparing to the other IT projects as they impact multiple systems, departments and employees and organisations itself. ERP is acknowledged as an integrated solution to architecture design combining formerly unconnected and inaccessible IS to offer them better leverage and enhance their performance. On the other hand, with many researchers presenting factors influencing ERP adoption and implementation, it may emerge unreasonable for SSOs to dedicate their endeavours to simultaneously address and understand these factors. To a certain extent, the author argues that this can as well be accredited to the lack of in-depth comprehension, expertise and knowledge on ERP systems adoption and implementation in SSOs specifically in the context of KSA (Al-Fawaz *et al.*, 2011). Moreover, a number of research studies also highlight that ERP implementation is in no way a risk-free project. In actual fact, researchers deem that ERP is often seen as high-risk and expensive projects (Themistocleous and Irani, 2002).

According to researchers this may need focusing on prioritising the factors and investigating those factors that are more important than others (Lee and Kim, 2000; Huang *et al.*, 2004). In recognising the importance of factors facilitates organisations to construct priorities and in return enhance the decision-making process (Lam and Chin, 2005). Salmeron and Herrero (2005) also stated that organisations may require considering the viewpoint of many individuals whilst performing the prioritisation of factors. Nevertheless, as respondents in the organisation are involved in different positions with distinct responsibilities, cultural backgrounds, such respondents may represent dissimilar views on the prioritisation of factors (Huang *et al.*, 2004; Lam and Chin, 2005). The varied views can possibly be combined by employing particular methods that previously have been deployed in the IT adoption and implementation and theorised in literature e.g. scoring, ranking, importance, mathematical optimisation and multi-criteria (Salmeron and Herrero, 2005; Wei *et al.*, 2005). However, the investigation of an appropriate technique or a method is presented in Chapter Four and applied in Chapter Five to evaluate the importance of factors in a practical arena.

With the abovementioned research evidences, the author recommends that it is vital to study the prioritisation of factors influencing ERP adoption and implementation in SSOs. Therefore, the aforementioned perceptions on prioritisation of factors may: *(a)* extend the current research on ERP adoption and implementation factors, *(b)* improve the level of ERP adoption and implementation assessment, and *(c)* support the decision-making process in SSOs to adopt appropriate ERP solutions. Thus, the author proposes the following research proposition for further investigation:

> ***Research Proposition 2 - Prioritising ERP Adoption and Implementation Factors:*** *Prioritising the factors based on their importance can influence ERP adoption and implementation in SSOs.*

3.2.3 Proposed ERP Adoption and Implementation Lifecycle Phases and Stages

In this section, author discusses ERP adoption and implementation lifecycle stages as part of the phases as discussed in Chapter Two. ERP adoption and implementation does not happen in isolation just by project team or IT managers or by vendor. This happens considering all linkages between functional departments. Therefore, the activities which makes up to the process of ERP adoption and implementation has various dimensions embedded into it, such as context of time, resources available, decision-making hierarchies, benefits, working systems and culture of the organisation. It can be inferred that ERP can be implemented as project, technical system or change in the organisation. However, in all cases, its adoption and implementation lifecycle involves sequential steps of distinct and consecutive stages of different set of activities an organisation passes through during the decision-making process (Frambach and Schillewaert, 2002). Generally, system development lifecycle covers the whole lifespan of a system starting from need or feasibility analysis to post-implementation maintenance and modifications, whereas, project view has more limited context in the sense of single cycle to meet the specific deliverables using given constraints of time, cost, resources and quality. Project may not be able to cover all aspects of lifecycle or it can be said to be a component of larger system lifecycle (Cadle and Yeates, 2008).

Literature on ERP adoption and implementation lifecycle is vast which has many frameworks and models of implementation provided by Esteves and Pastor (1999), Parr and Shanks (2000), Markus and Tanis (2000), Rajagopal (2002), Al-Mashari *et al.*, (2006), Peslak *et al.*, (2008), Chang *et al.,* (2008) and Law *et al.,* (2010). However, the most common flaw observed by the author in the literature is ambiguity surrounding the use of ‘phases’ and ‘stages’ in the lifecycle. This can be clarified by use of ‘macro’ and ‘micro’ view of ERP implementation. Each organisation is layered in terms of hierarchies, processes, functions, operations and stakeholders’ management. External vendors’ macro view of the client organisations would be exactly opposite from an employee view at operational level in the organisation. Hence, the author has divided lifecycle into phases as external layers and stages within each phase as more intricate elements. Hence, phases can be described as external view to understand ERP adoption and implementation, whereas, stages can be described as actual activities that would facilitate ERP adoption and implementation. This removes the ambiguity of phases and stages and would be more helpful in mapping critical success factors for ERP adoption and implementation SSOs. Based on these models, the author selected six stages for three lifecycle phases. Each phase contains one stage to initiate the process and other to complete the set of activities leading to next stage. These are:

- Pre-Implementation Phase (*Initiation Stage and Adoption Stage*)
- Implementation Phase (*Implementation Stage and Shakedown Stage*)
- Post-Implementation Phase (*Evaluation Stage and Optimisation Stage*)

The following sections are described ERP adoption and implementation phases and stages.

3.2.2.1 Pre-Implementation Phase

- **Initiation Stage:** This stage usually comprises of the activities which allows management to reach to a decision about ultimately to go for ERP, doing the need and feasibility analyses and selecting a vendor. This stage is very crucial because organisational requirement (need) and resource capacity (feasibility) is very necessary to ensure correct decision making. Secondly, rigorous choice analyses can lead to design and specificity in this stage itself which can facilitate advance planning and save time from further stages. Finally, this phase can facilitate the success evaluation of implementation. Various tools can be applied to measure the success of business case rationale (O'Brien and Marakas, 2007). Esteves and Pastor (1999) considered this as part of pre-implementation phase during which managers must question the need of adopting ERP while analysing that how new system would be the best suitable to address the business challenges existing in the organisation and be able to deliver the targeted improvement in performance and the organisational strategy. This stage would primarily generate the results of business reasons, technical reasons, goals, benefits and impacts analysis which leads to the decision of proceeding further or not to proceed further. Key players may vary during this stage but it usually includes the team of potential vendor, consultants, executives and IT managers. Any errors in estimations made during this stage can lead to major chaotic situations later on such as package and requirements mismatch, less fund allocation or inexperienced appointments (Markus and Tanis, 2000). Hence, this is the most crucial stage that acts as a foundation for implementation phase.

- **Adoption Stage:** This is part of initiation or chartering as there are lot of activities remain after decision to adopt and before actual roll out. This can also be termed as acquisition stage. This stage decides the planning and design on ERP based on the earlier need analyses in the initiation stage. Actual systems components and other features like price, training, project team, post-implementation maintenance, monitoring and return on the investment are decided during this stage (Esteves and Pastor, 1999). Markus and Tanis (2000) considered this stage along with roll out in the project phase of their model. According to them, key activities include software configuration, system integration, testing, data conversion, and training and roll out. The author considers roll out as the actual implementation activity. Ross and Vitale (2000) support this consideration and separates design stage from implementation. The approach stage includes design of technical and managerial processes along with configuring the ERP. Once the ERP is design then adaption and roll out of the whole system implementation is possible. Al-Mashari *et al.,* (2006) considered planning, design, choice of implementation type (big bang or phased), testing and team training as major activities during this stage before starting to implement the ERP. This adoption stage is equally vital in the pre-implementation as it would decide the complete process of implementation which would be difficult to correct once implementation starts.

3.2.2.2 Implementation Phase

- **Implementation Stage:** This stage usually consists of actual rolling out ERP in the organisation after all design and maintenance preparation is done. This stage has main activities in the form of installation and start using the ERP. Real time issues of running ERP become known during this stage. Roll out and acceptance of the ERP in the organisation by users in their daily transaction or business process forms the core of this stage. Vendors have after-sales responsibility providing know-how and required critical training to emerging issues during customisation or parameterisation while adapting and aligning the system in the organisation (Esteves and Pastor, 1999). Organisations have trade off in deciding whether to implement ERP in just one of the subsidiary or department to reach pass through stabilisation and continuous improvement or to implement all branches and departments worldwide or organisation wide at a time. This is considered as question of selection between phased and big bang approaches of implementation. Implementation period is considered to be highly disruptive, affecting business process and time consuming when going live (Ross and Vitale, 2000). Considering the EPR implementation on a Project Phased Model (PPM), Parr and Shanks (2000) divided implementation stage into five major activities: installation, configuration and testing, design, re-engineer and set up. Management support, balanced team combination, commitment to change and managing to deliverables according to pre-defined scope and goals are important factors for success during this stage.

The adaption of the new system may bring increased demand of usage, more training requirements, modifications required, better integration of units and enhanced utility and compatibility features which can affect further organisation wide acceptance and create a shakedown stage which is discussed in the next section (Rajagopal, 2002). Monitoring and adjusting all details generated from the ERP roll out is considered to be crucial for success in this stage (Al-Mashari *et al.*, 2006). Implementation does not bring sudden changes or improvement in the organisation but it is the perceived ease of use and its usefulness allow more user acceptance and leading this to complete acceptance level is the iterative process of use and advantages arising (Basoglu *et al.*, 2007). Implementation of ERP allows top management to gain control over entire business process (Sethi *et al.*, 2008) but it requires top management support (Somers and Nelson, 2001), project team competence and technical proficiency (Mendel, 1999), knowledge of company culture and communication by project team, vendors and consultants and how things work within the company (Plant and Willcocks, 2007). Based on maintenance and support services perspective of ERP adoption, Law *et al.*, (2010) categorises implementation stage into contagion, control and integration propose that higher degree of customisation and conflicting issues between stakeholders may affect the success of implementation. Comprehensive preparation and training plan with phased approach may lead to easier transition from one to other stage of performance derivation (Peslak *et al.*, 2008). Smooth transition would create less turbulence and consequences in shakedown stage which is explained as follows.

- **Shakedown Stage:** This stage is part of the implementation phase in the ERP lifecycle wherein post-roll out activities comprising of maintenance monitoring and modification are considered very vital to the overall success of implementation. This phase continues till operations after actual roll out become normal or system become routinely used. Key stakeholders during this stage are operations mangers, end users, remnants of the project team, IT support personnel and any external technical support people (Markus and Tanis, 2000). Activities during this stage shall lead to further stabilisation and routinisation of the usage of the ERP (Rajagopal, 2002). Duration of this stage largely depends on the speed of fixing bugs, resolving team conflicts and tuning the system into performance delivery mode and getting more people trained and included in the system usage (Markus and Tanis, 2000). Al-Mashari *et al.*, (2006) consider IT capabilities of team and vendor support as technical risks during this stage which can be resolved using goal clarity, top management involvement, leadership and training. From the literature, one can infer that shorter the shakedown period and easier the transition from turbulent to normal operation, more would be the successful implementation and benefits derivation. The evaluation of utility and tangibility of advantage of having ERP can be carried out during post-implementation phases which can be divided according to the priorities of activities.

3.2.2.3 Post-Implementation Phase

- **Evaluation Stage:** Titles given to this stage include evolution, post-implementation, onward and upward, continuous improvement and enhancement. The main activities remain same with all labels to monitor the post-implementation usage and advantages achieved by implementing ERP. This stage also allows top management to know the actual and tangible benefits of ERP (Esteves and Pastor, 1999; Markus and Tanis, 2000; Law *et al.,* 2010). This stage is supported by activities such as integration of more capabilities, advanced planning and expanding the collaboration with partners (Esteves and Pastor, 1999). In this stage, operations have already become normal and any modifications would happen in cases of: new edition of the ERP to be installed or corrections in the business process or system to fix problems in achieving the desired improvement. Common pitfalls in this stage are poor assessment and documentation with no organisational learning, no budget for post-implementation resources requirement and ignorance to further system requirements from users (Markus and Tanis, 2000; Ross and Vitale, 2000). Careful planning and prompt customer responsiveness approach can save planned benefits turning into risk and failure instead of success during this stage (Ross and Vitale, 2000). A successful evaluation would lead top management and implementation management team to link core values derivation to overall organisational benefits and further optimisation of this alignment and ERP implementation.

- **Optimisation Stage:** Constant re-assessment of business process and organisational processes in congruence with ERP value delivery would allow management and project managers to transform organisation based on ERP to another level of success. Optimisation stage activities include transforming the organisation based on the success of ERP implementation. This stage occurs only when ERP system is free of conflicts, technical bugs and repairs where maintenance is regularly carried out and support is continuous (Parr and Shanks, 2000). Organisation is able to improve its competitive positioning in the industry as a result of achieving continuous improvement (Markus and Tanis, 2000). Organisational benefits and integration of the system with planned goals is properly aligned during this stage, system is accepted by all functions and 'zero flaw' level is reached (Rajagopal, 2002). Enterprise efforts are realised in terms of tangible benefits and relationship between costs – benefits as optimised status is planned as further roadmap while organisation successfully looks for better positioning and more opportunities in the business environment (Al-Mashari *et al.,* 2006).

Post-implementation process mainly includes collection and utilisation of knowledge and learning throughout the organisation to optimise the delivery and the outcome of completed and future ERP implementation. Implementing successful and effective monitoring, evaluation and optimisation system during the post-implementation of ERP would require application of learned knowledge, access to all elements generating vital information, top management support and project team dedication to achieve higher levels of improvement. ERP implementation passing through these six stages successfully would lead ERP team management to allow recurrence of this six stage implementation cycle and derive more benefits. The aforementioned phases and stages are exhibited in Figure 3.3.

The proposed adoption and implementation lifecycle phases and stages are still to be assessed in the context of a practical setting. However, these adoption and implementation lifecycle phases and stages may be deemed whilst adopting and implementing ERP systems to: *(a)* extend the current research in ERP adoption and implementation i.e. factors and adoption and implementation lifecycle phases and stages, *(b)* enhance the level of ERP adoption and implementation analysis i.e. mapping of factors on adoption and implementation lifecycle phases and stages and *(c)* support SSO decision makers to while adopting and implementing ERP systems. Thus, the author proposes the following research proposition for further investigation:

Research Proposition 3 – Adoption and Implementation Lifecycle Phases and Stages: *The service sector organisations can pass through several adoption and implementation lifecycle phases and stages while adopting and implementing ERP systems.*

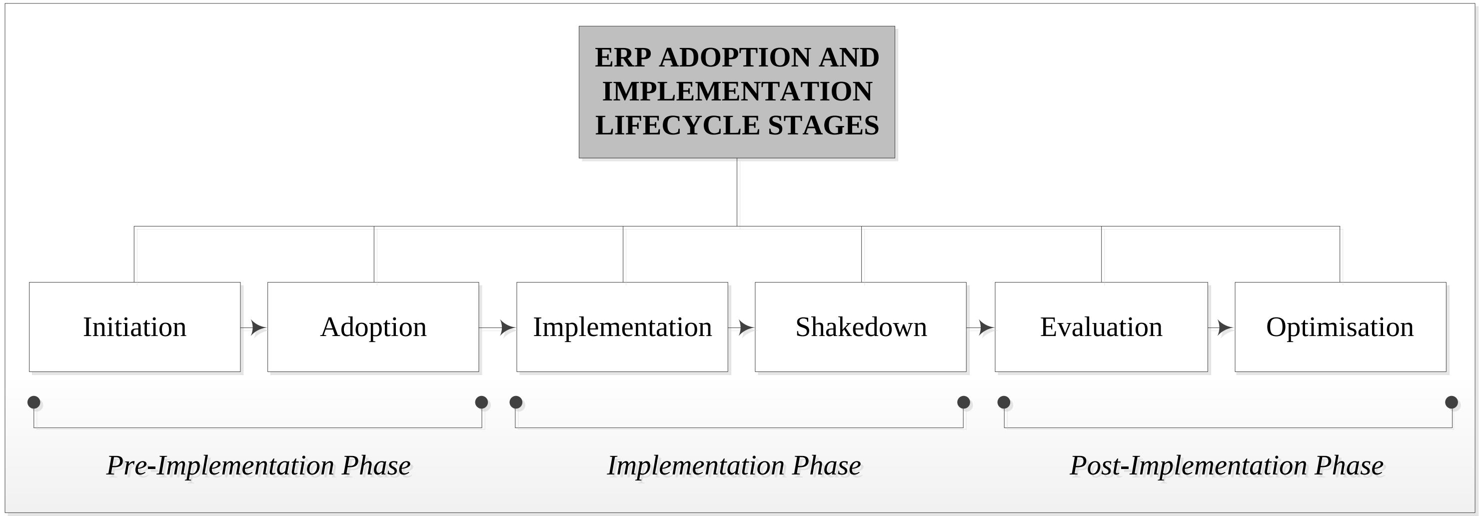

Figure 3.3: Proposed ERP Adoption and Implementation Lifecycle Phases and Stages

3.2.4 Mapping ERP Adoption and Implementation Factors on Adoption and Implementation Lifecycle Phases and Stages

The research conducted up till now highlights that the process of ERP adoption, implementation and utilisation in different sectors such as multinational, healthcare, SMEs, government organisations and other public sector entities has been important to deriving the benefits of enterprise resource planning systems (e.g. Markus and Tanis, 2000; Ross and Vitale, 2000; Somers and Nelson, 2001; Al-Mashari *et al.*, 2006). The extant research on ERP adoption and implementation has investigated on factors, as highlighted in detail in Chapter Two and earlier in this chapter. Nevertheless, from a conceptual and empirical viewpoint, none of the extant research studies on ERP adoption and implementation have investigated the mapping of the factors influencing ERP adoption and implementation process on different lifecycle phases and stages. This can be deemed as a literature gap and reports that it is vital to comprehend and administer the ERP adoption and implementation process in SSOs. This can be accredited to many reasons (both in the areas of ERP and SSOs) including among others: *(a)* ERP is very often deemed as high-risk and expensive projects, *(b)* propagation of ERP packages solutions from different vendors. On the other hand, SSOs are characterised as service oriented organisations and may resist to the technological changes, on the other hand, these changes should thus be administered as their significance in bringing about change in the organisation is essential. Having discussed the abovementioned, the author asserts that it is worth to study the mapping of factors influencing ERP adoption and implementation in SSOs on different lifecycle phases and stages. Along with the anticipated factors influencing ERP adoption and implementation in SSOs, the mapping of factors influencing ERP adoption and implementation in SSOs on different phases and stages of the lifecycle also contribute at the conceptual level. On the other hand, the definite mapping of factors on different stages of the lifecycle will be carried out after conducting empirical research as part of Chapter Five. Thus, the author proposes the following research proposition for further investigation:

> ***Research Proposition 4 - Mapping ERP adoption and implementation Factors:*** *The influential factors for ERP adoption and implementation can be mapped on different lifecycle phases and stages to support the decision makers while adopting and implementing ERP systems.*

Figure 3.4 illustrates an example of the aforesaid research issue, where one or more influential factors are mapped on different phases and stages of the lifecycle. This exemplar illustrates that different factors may influence the decision-making process for ERP adoption and implementation on different stages of the lifecycle.

Initiation Stage	Adoption Stage	Implementation Stage	Shakedown Stage	Evaluation Stage	Optimisation Stage
Factors	Factors	Factors	Factors	Factors	Factors
F1	F1	F3	F2	F3	F4
F3	F2	F5	F3	F4	F5
F6	F5	F10	F5	F5	F6
F9	F8	F11	F9	F9	F7
F12	F15	F14	F12	F15	F9
F13	F18	F15	F19	F20	F15
...	...	...	...	...	...
FX	FX	FX	FX	FX	FX

Figure 3.4: Example of Mapping of ERP Adoption and Implementation Factors on ERP Adoption and Implementation Stages

(F = Factors)

3.2.5 Proposed Conceptual Model

Literature highlighted in the previous sections illustrates that the role of factors, prioritising the importance of ERP adoption and implementation factors, ERP adoption and implementation lifecycle phases and stages and, mapping of factors on adoption and implementation lifecycle phases and stages can be considered to be of high importance during ERP adoption and implementation process in SSOs. As a result, the author proposes that when exploring ERP adoption and implementation in SSOs: *(a)* the identification of factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation may provide a deeper understanding of such interrelationships within SSOs, (c) the identification of ERP adoption and implementation lifecycle phases and stages, and *(d)* the mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages. Figure 3.5 presents a detailed conceptual model for ERP adoption and implementation in SSOs.

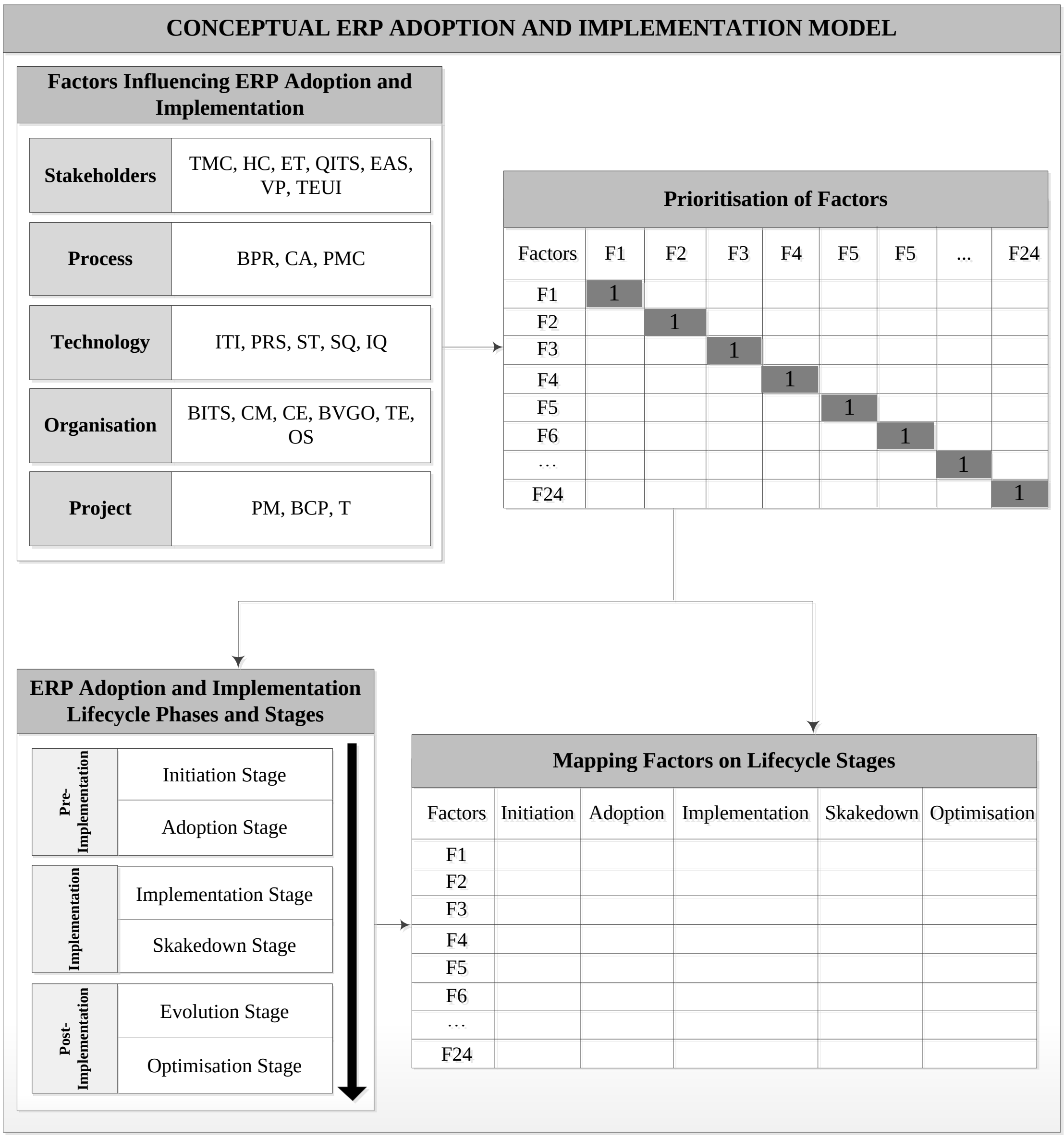

Figure 3.5: Proposed Conceptual Model for ERP Adoption and Implementation in SSOs

The proposed model (Figure 3.5) consists of:

- The proposed factors influencing ERP adoption and implementation in SSOs,
- The ranking of factors based on their importance (i.e. priority),
- The ERP adoption and implementation lifecycle phases and stages, and
- The mapping of the ERP adoption and implementation factors on different ERP adoption and implementation lifecycle stages.

The above presented model is in accord with the aim of this thesis i.e. proposing a model for ERP adoption and implementation in SSOs in order to support the decision-making process. The proposed model in Figure 3.5 aims to contribute to the body of knowledge as it: *(a)* incorporates and combines existing and new factors, *(b)* present new facets for the exploration and examination of the ERP phenomenon e.g. categorisation of factors, prioritisation of factors, adoption and implementation lifecycle phases and stages, and mapping of factors, *(c)* offers detailed medium of evaluation and *(d)* enables SSOs, academics, practitioners in making appropriate decisions for ERP adoption and implementation. To test this model in the context of SSOs, the author proposed four research propositions summarised in Table 3.1.

Proposed Research Propositions for Further Investigation	
Research Proposition	**Description**
ERP Adoption and Implementation Factors	• Proposed factors (Figure 3.2) can influence the decision making process for ERP Adoption and Implementation in SSOs.
Prioritising ERP Adoption and Implementation Factors	• Prioritising factors based on their importance can influence ERP Adoption and Implementation in SSOs.
ERP Adoption and Implementation Lifecycle Phases and Stages	• SSOs can pass through several phases and stages while adopting and implementing ERP systems.
Mapping ERP Adoption and Implementation Factors on	• The influential factors for ERP Adoption and Implementation can be mapped (Figure 3.3) on different ERP Adoption and Implementation Lifecycle Phases and Stages to support the decision makers while adopting and implementing ERP.

Table 3.1: Proposed Research Propositions for Further Investigation

3.8 Conclusions

The author identified a void in the literature dealing with the absence of theoretical models for ERP adoption and implementation in SSOs. Literature indicates several ERP adoption and implementation models that provide an understanding of the principles behind ERP adoption and implementation in the public and private domain. The existing ERP adoption and implementation studies are based on the factor-oriented approach illustrating several factors influencing ERP adoption and implementation. Thus, following the research trends the author considered the factor-oriented approach for this research. In doing so, the author used EAI adoption model by (Kamal, 2008) as the basis for this research. Using the concepts of this model the researcher further expanded the scope of the research by exploring the SSO area. In doing so, factors were identified as proposed and explained in detail in Section 3.2.1. These factors make a novel contribution at the conceptual level for ERP adoption and implementation in SSOs.

To extend this current research and improve the decision-making process in SSOs, the author discussed on several theorised conceptions on the prioritisation of factors from the literature in Section 3.2.2. The author asserts that this may offer proper insights towards better comprehending the importance of factors influencing ERP adoption and implementation in SSOs. Moreover, the author presented different ERP adoption and implementation lifecycle phases and stages in Section 3.2.3. The adoption and implementation lifecycle phases and stages were identified by analysing different IT/IS adoption models. In joining together the research i.e. the factors, prioritisation technique, lifecycle phases and stages, mapping of factors, proposes a conceptual model for ERP adoption and implementation in SSOs. This model combines the proposed influential factors for ERP adoption and implementation with the adoption phases and stages. The next chapter presents the research methodology employed to test the proposed ERP adoption and implementation model and research propositions proposed for further investigation.

4

Chapter Four: Research Methodology

4.1 Introduction

In Chapter Three, the conceptual model for ERP adoption and implementation in SSOs was proposed and described. This chapter describes the research methodology adopted and the justification for selecting an appropriate research methodology. Therefore, this methodology is transformed into a protocol, which acts as a data collection tool where data are inferred from two service sector case studies, such that the proposed research questions can be answered and the conceptual model validated.

4.1.1 Chapter Objective

This chapter aims to prepare a research plan which will eventually lead to the assessment and evaluation of the proposed conceptual model as described in the Chapter Three. The research plan begins with developing a methodological frame to build the research design. The rest of the chapter provides selection of each research design element and justification for their selection.

4.1.2 Chapter Structure

Initially, Sections 4.2, 4.2.1 and 4.2.2 review on different epistemological stances (e.g. positivism, critical theory, post-positivism and interpretivism). Based on the analysis, the author selects and justifies interpretivism as the research approach that is adopted by this thesis. Then, in Section 4.3, the author explains the reasons for selecting qualitative research in this research and further illustrating the benefits and limitations of qualitative research. In Section 4.4, the author opts for and interprets a suitable research strategy that justifies the adoption of a case study based research in Section 4.4.1 and further differentiates between single and multiple case studies in Section 4.4.1.1. Thereafter in Section 4.5, the author presents an empirical research methodology. This research methodology acts as a framework for conducting the empirical enquiry.

Whilst explaining on the research methodology, the author also exemplifies and justifies the adoption of AHP technique to prioritise the importance of ERP adoption and implementation factors. Research community accentuates bias as a possible risk while using the qualitative research approach. Nevertheless, the author overcomes the possibility of bias in this research through data triangulation as exemplified in Section 4.6. Section 4.7 illustrates case study protocol. Finally, Section 4.8 brings this chapter to an end by summarising the conclusions.

4.2 Selecting a Suitable Research Methodology

While information systems area is multi-disciplinary with many of its facets are related to specialised subjects, due to this the identification of a suitable research methodology is not a straightforward undertaking (Orlikowski and Baroudi, 1991). Moreover, IS researchers (e.g. Orlikowski, 1991; Galliers, 1992) argue that in the IS discipline, there is lack of a single or a comprehensive framework that incorporates all the domains of knowledge deemed vital to research in the IS discipline. The latter argument is supported by Walsham (1995), who state that opting for an appropriate research methodology is the foremost vital undertaking in the research design process. Galliers (1994) also reported that there are a number of research methodologies that academics can choose from. IS discipline is not entrenched in a single theoretical or hypothetical perspective; however, there is an extensive array of theoretical suppositions in relation to the fundamental nature of phenomena (i.e. ERP adoption and implementation) under examination (Orlikowski and Baroudi, 1991). Therefore, a number of research methodologies exist that IS researchers can make use of (Galliers, 1985).

4.2.1 Research Philosophy

Research philosophy is about how researchers and respondents perceive what is being investigated and their stance about intervening and believing the results (Gray, 2009). The contribution by research community to the domain of knowledge and theory building is multifaceted and the main objective for research academics is to find answers to the problems and trade-offs posed by basic and applied dimensions of business and research. Hence, the selection of research philosophy must be determined as a principal direction setting element in the research design before carrying out actual research (Bryman and Bell, 2007). Major dimensions of research can be defined as the way the research would be utilised, the purpose of the research, time line context and methods selected for data collection and analyses (Saunders *et al.*, 2007). In this thesis, the author attempts to explore and review: *(a)* the phenomenon of ERP adoption and implementation, *(b)* critical success factors influencing

ERP adoption and implementation, and *(c)* ERP lifecycle phases and stages [i.e. pre-implementation, implementation and post- implementation] and

The research philosophy relates the research to the way a researcher perceives the development of knowledge and the assumptions made by researcher to carry out the analyses and inferences (Cresswell, 1994). The researchers in the IS discipline usually deploy qualitative research methods in the form of selecting positivist, interpretive or critical research philosophy. These three philosophies have roots in the epistemological consideration that how to obtain knowledge or to know about the theory of knowledge in the specific subject (Orlikowski, 1991; Myers and Avison 2002). This thesis refers to the epistemological type research since it involves concerns about what constitutes CSFs and the lifecycle phases and stages in ERP adoption and implementation (Collis *et al.*, 2003). The topic under investigation in this thesis is about advocating the necessity to review the subject, and in addition, to emphasize the phenomenon by exploration, description and further interpretation to build up the theory (Saunders *et al.*, 2007). Table 4.1 highlights the distinctions and underlying assumptions between the three abovementioned research philosophies.

Research Philosophy	Description	References
Positivist	• Pre-conceived law like scientific theories; • Testing and proving theories comprising variables and hypotheses; • Researcher takes the role of an observer; • Attempts to increase the predictive understanding of the phenomena; • Usual for laboratory experiments – forecasting – simulation.	Galliers (1992); Orlikowski and Baroudi (1991); Sekaran (2003).
Critical	• Social reality is historically constituted; • Social reality is produced and reproduced by people; • Social – cultural and political conditions influence ability of people to act; • Main task as a social critique to understand restrictive and alienating conditions.	Hirschheim and Klein (1994); Myers and Avison (2002); Saunders *et al.*, (2007).
Interpretive	• No preconceived theories; • Knowledge of reality is gained through only social constructions; • Signifies the complexity of human sense as situation changes; • Researcher participates in the empirical study; • Usual for subjective review – debates – descriptive interpretations.	Galliers (1992); Kaplan and Maxwell (1994); Walsham (1995); Irani *et al.*, (1999); Gray (2009).

Table 4.1: Differences in the Research Philosophies

4.2.2 Justifying an Interpretive Research Based Approach

The multiplicity of research exemplars puts forward multifaceted challenges for the selection of the appropriate approach for this research. In the context of this thesis, the author selects and justifies the selection of an interpretive research based approach as an appropriate underlying research assumption for investigating ERP adoption and implementation in SSOs. The reasons for selecting of interpretive research based approach are threefold:

- The critical analysis of the literature and initial theoretical framework presented in Chapters 1, 2 and 3 describe the importance of organisational, business process and technological factors associated with ERP adoption and implementation. The concurrent influence of these factors and inter-relationships between them is complex to understand. This requires critical understanding of these factors through interpreting them in different organisational contexts. In addition, these factors require prioritising and mapping against each lifecycle phase and stage, which will support case studies to strengthen their decision making process for ERP adoption and implementation. Thus, research in this thesis requires interpretive philosophy that will facilitate the author in understanding the process of ERP adoption and implementation and further, support in prioritising and mapping the influential ERP factors via pragmatic research.

- Secondly, the author considers interpretivism as an appropriate philosophical stance for this research, as it is important to understand different conceptions from managers and users viewpoints without any bias. This in turn will require rich and specific description of this subject. This aspect of the research study makes interpretivism as an appropriate philosophical tool to proceed. The author adopted the interpretivism research philosophy while not giving much attention to generalising the results. The rationale behind this decision is that organisations from different sectors have different resources and competitive positioning that may allow them in the future to modify the theoretical proposition put forward by author in this thesis (Bryman and Bell, 2007; Saunders *et al.*, 2007). This stance of philosophical approach is also known as phenomenological paradigm in the research world in which investigation is about a fact or occurrence that appears to be perceived relating problem or research question (Collins and Hussey, 2003). This stance is preferred by researchers especially when carrying out studies to develop the theoretical issues and building up the conceptual and substantive theories (Bryman and Bell, 2007).

- Thirdly, as the social world cannot be condensed to isolate determinants, such as space and mass, it must be experimented and observed in its entirety. Literature indicates that results produced by positivist approaches are generalisable merely in circumstances under which data are gathered subsist in the communal world (Shaw, 1999). Therefore, the author argues that to investigate ERP adoption and implementation in SSOs, a suitable research approach is required that may facilitate SSOs to be sighted and understood in their totality and enable the academics and researchers to come together with the respondents, infiltrate their actualities, and enlighten their perceptions.

The selection of such research philosophy consequentially leads one to preferential choice of inductive research approach which is explained in the next section. Therefore, based on the abovementioned three assertions the author considers interpretivism as more suitable for the research reported in this thesis.

4.3 Justifying the Use of Qualitative Research Approach

A research approach is considered as a main element of research helping researchers to decide how to carry out the actual research design and field work processes. It is about the way researchers prefer to approach the theory involved in the research frame (Saunders *et al.*, 2007). The author identified several theoretical issues from extant literature on ERP, its perspectives, implementation and relevant case analyses (as highlighted in Chapters 1, 2 and 3). The extant literature is specifically limited in clarifying on critical success factors, lifecycle phases and stages and their root causes all in conjunction. In addition, there is limited research conducted in the area of SSOs and more specifically, in the Middle East region with regards to ERP adoption and implementation. Thus, this is the initial rationale that influenced the author in selecting qualitative research approach for this thesis. Qualitative research entails interpreting non-numerical data i.e. data extorted directly from the intended interviewee (Miles and Huberman, 1994). Advocates assert that qualitative method is a collection of interpretive modus operandi which seeks to illustrate, decode, transform and or else come around the conditions with the meaning (Van, 1983).

According to Denzin and Lincoln (1994), qualitative research is multi-method that entails an interpretive and naturalistic approach to its topic. The term ‘interpretive’ research is recurrently employed interchangeably with the ‘qualitative’ research in the literature (Galliers, 1992). The latter arguments are also supported by Hakim (2000), who highlight that qualitative research is primarily employed in research studies and areas in which the prominence is on the explanation and description as compared to those research studies that focus on predictions. The literature theorised conceptions indicates several perceptions, conventions and suppositions in relation to qualitative based research e.g. positivism, post-positivism, and others related to social and interpretive studies. Thus, in order to comprehend qualitative research in detail, the author thought to highlight a comparative analysis with the quantitative research, as presented by Missi (2005). The author makes use of this comparative analysis in order to provide more details before appropriately justifying the use of qualitative research (subsequently after Table 4.2). The differentiation presented in Table 4.2 is primarily developed out of the quantitative research's positivist standpoint and the qualitative research's non-positivist standpoint.

Research Approach	References	Research Approach	References
Quantitative • Employing statistical and arithmetical techniques to explore phenomena and the underlying associations. In this research, sample data can be significantly large and descriptive.	Lincoln and Guba, (2000)	**Qualitative** • Such research establishes what objects subsist as compared to the number of objects. This type of research is usually less ordered and more particular to requirements and nature of research circumstances.	Nissen, (1985).
Positivist • Conviction that the social world agrees with the predetermined regulations of causation. Intricacies in such research are handled via reductionism.	Klein and Lyytinen, (1985)	**Interpretivist** • It indicates that there is lack of worldwide reality. Offers comprehension from researcher's individual context.	Bogdan and Taylor, (1975)
Confirmatory • Such research deals with proposition development and testing and theory confirmation. It is also noted that such research is inclined towards positivist/quantitative research.	Ives and Olson, (1984)	**Exploratory** • Such research is related to determining precedents in research data and to interpret them. It places essential explanatory underpinning. Possibly will lead towards the development of hypothesis.	Trauth and O'Connor, (1991)
Deduction • Such research employs broad-spectrum outcomes to assign properties to particular occurrences. It is also related with theory confirmation and proposition analysis.	Mintzberg, (1979)	**Induction** • Particular illustrations employed to appear at whole generalisations. Condemned by theorists and academics, however, is vital in theory/ hypothesis formation.	Hirschheim, (1985)

Table 4.2: Differentiation in Qualitative/Quantitative Approach *(Adapted: Missi, 2005)*

Having presented the comparison in Table 4.2, the author reports that this thesis employs the qualitative research approach. The prime rationale is that researchers employing this methodology examine objects in their natural surroundings. Schutz (1967) and Denzin and Lincoln (1994) reported here that the essence here in this methodology is to understand a particular phenomenon or a fact with regards to the connotations that individuals in that natural surroundings bring to them and more importantly, examining individual behaviours as part of daily life. This thesis focuses on ERP adoption and implementation in SSOs. The study of individual dealings and activities in SSOs may differ from those in other sector organisations, as it is fundamentally related to the nature of certainty in the societal world. Thus in this regard, the doctrine of methodical methods and approaches e.g. the quantitative research methods employed whilst researching on individual is questionable, and as a result, the author suggests employing qualitative methodology. The latter arguments are supported by Marshall and Rossman (1999), who evaluated a number of research studies that qualitative research method probably be suitable for. Some of the exemplars of these types that in addition relate to the needs of the current thesis research (i.e. ERP adoption and implementation in SSOs) are presented as follows. For instance, research that focuses on:

- Investigating critical success factors, prioritising the importance of factors, lifecycle phases and stages, and mapping the factors on lifecycle stages;

- Comprehensively investigating intricacies and business processes with regards to ERP adoption and implementation;

- Investigating a limited recognised phenomenon i.e. ERP adoption and implementation in SSOs.

- Facilitating the author of this thesis with widespread agility whilst interviews and observations in the case study organisation, and

- Researching ERP adoption and implementation in a natural venue (two service organisations in KSA) and build up pertinent theories from the pragmatic knowledge and experience acquired.

The abovementioned discussions highlight the involvement of individuals and organisations and in such situations Remenyi and Williams (1996) suggested that qualitative research methods should be employed. It seems that quantitative research methods are unsuitable in such situations where they are incapable differentiating amid individuals and the objects of the natural sciences. IS research discipline is related with the individuals and thus, any methodology that employs quantitative research methods ought to be familiar with the inconsistency that is inbuilt in individual actions. With the abovementioned epistemological standpoint as part of this thesis, the author asserts that qualitative research is opted to be more suitable for this research base on the below mentioned rationales:

- Qualitative research is valuable primarily as contextual information/data is gathered from the natural surroundings (e.g. ERP adoption and implementation in the context of SSOs), as a result, facilitating the consequence of the surroundings to be considered, and it is filled with richness and holism.

- As discussed earlier, qualitative research is multi-method that enables researchers to appropriately plan in inquiring from the respondents, as a result, encouraging more instinctive and pragmatic data making it a suitable and valuable approach for this thesis research.

- The author reports in Chapters 1, 2 and 3 that there is inadequate research conducted on ERP adoption and implementation in SSOs. In this standpoint, the author asserts that qualitative research possibly will support to investigate ERP adoption and implementation in its natural surroundings (i.e. KSA SSOs). The author asserts that this research will also enable in comprehending the nature and the intricacy of ERP adoption and implementation processes in SSOs (as it is also highly theorised in the literature).

This section highlights the research suppositions and approaches. Based on the latter discussions in this section, the author asserts that qualitative research is a helpful approach in acquiring better comprehension of the phenomena under investigation. The next section discusses on opting for an appropriate research strategy.

4.4 Selecting an Appropriate Research Strategy

According to Galliers (1992), research strategy is about conducting research, employing a particular research approach and using distinct research methods in order to gather data. The author reports that different research strategies are required to be examined, in order to opt for a suitable one that would support the author is collecting and analysing the data. Moreover, the attributes are required to be investigated, and a research strategy ought to be justified in light of these research attributes. According to researchers such as Cavaye (1996) and Saunders *et al.*, (2007) although there are several strategies but the most common them include single or multiple case study based research, experiment, survey, field study, longitudinal studies, action research, grounded theory, exploratory, ethnography, explanatory and descriptive research studies. In the case of the latter, Yin (2009) stressed the need to focus on the following three criteria in order to select and or distinguish amid different research strategies, such as the:

- Sort of the research question(s) proposed by the research in context,
- Degree of influence the author has on factual behavioural proceedings, and
- Scope of concentration on current proceedings as compared to those of the preceding proceedings.

In the following section, the author justifies the suitability of case study based research strategy for this research.

4.4.1 Justifying the Use of Case Study Research

According to the IS research community, case study based research is a prominent and leading research strategy, specifically in the context of theory development and testing (Orlikowski and Baroudi, 1991; Galliers, 1992; Yin, 2009). Case study based research is seen as a common research strategy in disciplines such as community planning, economics, sociology, psychology, business, and political science research (Ghauri and Grønhaug, 2002). Cavaye (1996) argued that in these disciplines, the individual requirement for case study research illustrates a way to standardise inspection and aims for profound comprehension of intricate social phenomenon. A case study is an exhaustive assessment of an observable fact in its natural surroundings, making use of numerous methods of data collection from one or more individuals or groups (Yin, 2009). Data can be collected through different means such as interviews, questionnaires, observation, and written materials. According to Cavaye (1996), a case study based research is usually considered as very well structured (i.e. positivist, deductive investigation of numerous cases); unstructured (i.e. interpretive, inductive investigation of a single case study); finally, it can be anything in the middle of the structured and unstructured extremes in roughly any permutation. The latter interpretation denotes that a case study based research can be possibly be utilised in several ways with distinct research output and findings for each case study.

In this research, the case study based research strategy is classified as exploratory research, as the current research focuses on questions of what type (e.g. what are the factors that influence the ERP adoption and implementation in SSOs, etc). Exploratory case studies are constructive for theory development as they are important in developing and cleansing conceptions for future research (Roethlisberger, 1977). In summarising the rationales for opting a case study based research strategy, the author perceives that:

- Case studies prove to be a valuable tool in understanding, extending, exploring and explaining the subject under investigation such as ERP in the context of this thesis (Gray, 2009).

- They are often associated with qualitative studies because they are advantageous "*to use in assessing a contemporary phenomena within real life context when boundaries between phenomena and context are not clearly evident"* (Yin, 2009). This is true in case of differences between implementation stages or lifecycle stages and project management view or change management view of ERP systems as new projects.

- A rich understanding of the context of research and the processes being extracted is required in this project (Saunders *et al.*, 2007, p.139).

- Inductive and exploratory research with multiple cases is pure theory development approach favouring the use of case study method (Gray, 2005).

- Well designed and properly constructed case study can provide results strong enough to challenge the existing literature or theories (Saunders *et al.*, 2007).

The aforementioned conceptions, richness of the phenomenon and extensiveness of the context of ERP systems implementation make the case study research strategy appropriate for investigating ERP adoption and implementation in SSOs (Yin, 2009).

4.4.1.1 Single and Multiple Case Study Research

The research design links the data to findings through research questions while articulating the theory associated with the subject under investigation. Case study research designs depend upon study questions, its propositions, units of analyses, research logic and ways to interpret results. Researchers can undertake a single or multiple case studies for their research endeavours; however, the decision to whether select merely single case study or multiple case studies is highly vital and depends on the case study design. In the context of single case study, each can be regarded as holistic (i.e. a sole entity to examine) or also entrenched (i.e. more than single entity to examine). According to Cavaye (1996), a single case study possible facilitates the researchers to investigate a specific phenomenon in detail, moving near to the phenomenon, offering productive prime data and illuminating its detailed structure inside the organisational environment. For the purpose of this research, the author perceives that it possible will facilitate in developing a comprehensive representation of the organisation's operational idiosyncrasies and further facilitate the author in investigating ERP adoption and implementation in SSOs. Since ERP is a complex undertaking and its adoption and implementation may result different in different organisations, in this case single case study may not offer adequate insights to this phenomenon. Most of the research endeavours require more than a single case e.g. the existing research context, as single case studies are merely valuable in particular situations. For example, Yin (2009) suggested that single case study is suitable only if the case study:

- Is a *revelatory* undertaking, i.e., it is a state of affairs formerly unreachable to methodical examination.

- Corresponds to a *critical* undertaking for validating and assessing a well developed theory.

- Is a *radical* or *exceptional* undertaking.

From the above discussions, it is clear that single case study undertakings are highly valuable at the beginning of theory development and at the end of theory testing (Bonoma, 1985) and this is not the case in the context of this research. Benbasat *et al.,* (1987) also recommended that a single case study conducted for investigation possibly will result in multiple case study undertaking. As a result of the latter and specifically in light of the features of this thesis research, the author argues that a single case study is not suitable; instead, a multiple case study research is suitable in this research context as it will facilitate the author in investigating and cross-checking the empirical findings. Herriot and Firestone (1983) support the latter and state that multiple case studies offer research endeavours with a vigorous investigation of cause and effect association of the units of analysis.

Conducting multiple case designs removes the disadvantages of single case analysis as it can allow more sensitivity and any slippage between research questions and central theme of the study at an initial stage (Gray, 2005). The barrier to use of multiple case studies can be complexities like requirement of resources and access to information from multiple cases (Yin, 2009). Idea to use multiple cases can result into theoretical or literal replication. Replication can be in the form of findings getting repeated for different cases (literal replication) or contrasting results for anticipated reasons in different cases (theoretical replication). This would allow the theoretical proposition to become the vehicle to make generalisations for new cases. This may take the form of replicating experiments with multiple number cases as iterations (Yin, 2009). In the context of this thesis, a multiple case study strategy has been adopted to study ERP systems implementation in SSOs in the Kingdom of Saudi Arabia (KSA).

4.5 Empirical Research Methodology

One frame of mind in relation to the phases of the research process is with reference to the research wheel (Rudestam and Newton, 1992). The wheel representation supports the fact that research is not linear but a recursive sequence of steps that are reiterated at different times, for the rationale of authenticating the pragmatic stages with the theory from where the hypothetical perceptions stem out. The applications of a series of formalised course of actions that are unrestricted and thorough at the same time are vital of a qualitative research design (Flick, 1998). Jankowicz, (2000) proposed a pragmatic research methodology that is based on three stages, namely: *(a)* research design, *(b)* data collection, and *(c)* data analysis. In the context of this research, the author developed a similar pragmatic research methodology that works as the design for this thesis research process. The latter is achieved in order to evaluate the conceptual model proposed in Chapter Three and the research questions related to ERP adoption and implementation in SSOs.

4.5.1 Research Design

Research design is the preliminary autonomous phase of the pragmatic research methodology that includes a number of sequential steps. Fundamentally, this phase commences by obtaining backdrop knowledge of the subject under research, critically examining the literature and further investigating and clarifying the problem area. In the literature review chapter, the author indicated some research questions. The author asserts that this leads to a particular research context and explores a research requisite. As a result, a conceptual model is developed in Chapter Three in order to signify the proposed empirical research, and the facets of the model will be investigated by means of empirical case studies. Figure 4.1 represents the overall intended empirical research. The four different dimensions (i.e. factors, prioritisation of factors, ERP lifecycle phases and stages and mapping of factors) were investigated via empirical research. Having discussed the needs of the empirical research, the author come to a decision that this thesis (in its research design) will employ a multiple case study strategy via the qualitative research methods (as justified in Section 4.4.1.1). The research design was later on transformed into a plan of modus operandi. Such research action plans are a vital examination tool for a number of rationales, such as to:

- transform the task of data collection in an comprehensible and controllable plan;
- assure all the need primary data is gathered and discarding the irrelevant data;
- indemnify that this thesis research practices a particular plan and achieves targets;
- follow the conduit during which knowledge was generated; and
- works as a plan for other researchers to and accomplish analogous assumptions. The author reports that this is required where the investigating questions are opinionated, and the research depends on qualitative methods.

Figure 4.1 illustrates the design for the research process for this thesis.

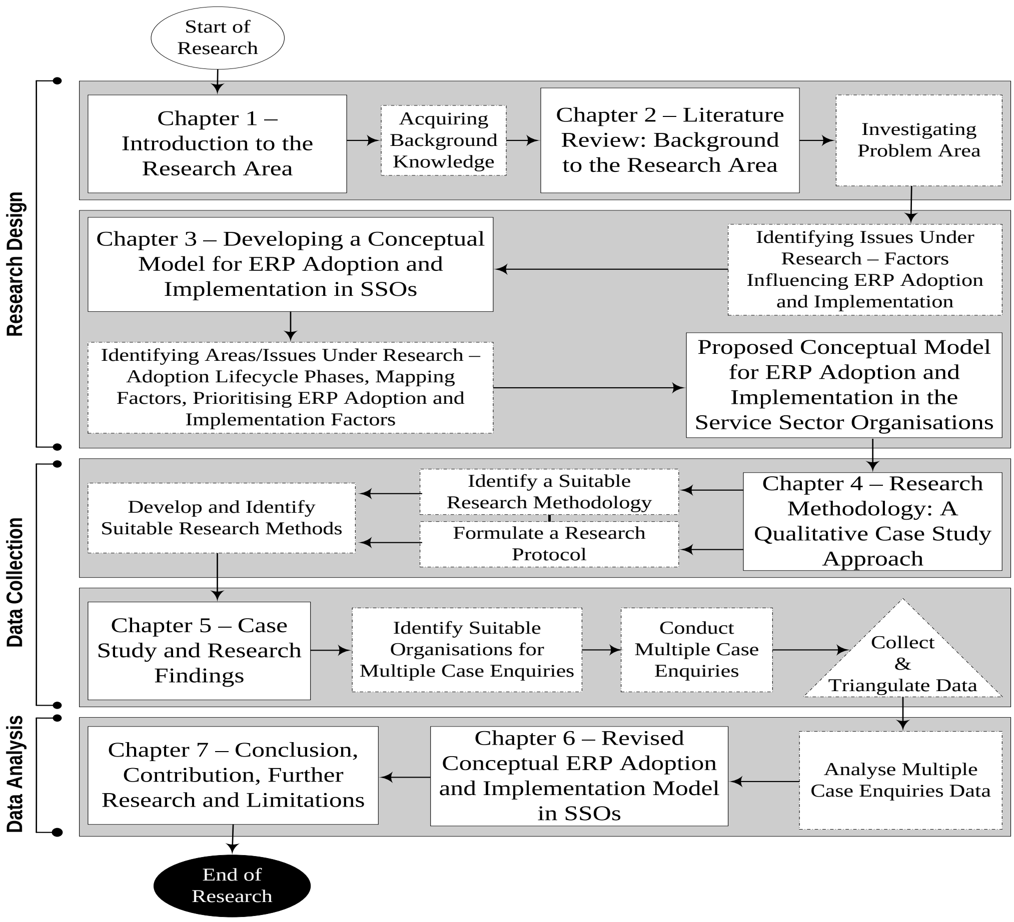

Figure 4.1: Empirical Research Framework of the PhD Process

4.5.2 Methods of Data Collection

Literature presents a number of research studies employing one or more methods for empirically collecting data. These methods are referred to as a source of evidence (Yin, 2009). However, as discussed in the literature case study based research studies utilise a number of methods for collecting data to offer strong validation of theory (Eisenhardt, 1989). Preferably, verification from two or more sources will congregate to support the overall empirical research findings. Yin (2009), for example explores a number of sources of evidences employed in case study based research (as illustrated in Table 4.3).

Sources of Evidence	Strengths	Weaknesses	Use of Sources in this Research
Documentation	• Stable–can be reviewed repeatedly. • Unobtrusive – not created as a result of the case study. • Exact–contains exact names, references and details of the events. • Broad coverage–long span of time, many events and settings.	• Retrievability-can be low • Biased selectivity, if collection is incomplete. • Reporting bias-effects (unknown) bias of author. • Access-many be deliberately blocked.	• Annual reports from the case study under study. • Organisational white papers and relevant documents related to e.g. ERP contract agreements, IS planning documents, IT strategic plan, ERP main plan and implementation blue prints. • Reference material from the relevant case (e.g. history, structure, business lines, etc).
Archival Records	• [Same as above for documentation] • Precise and quantitative	• [Same as above for documentation] • Openness due to privacy reasons	• Deliverables on preceding projects in case studies. • Case studies archives.
Interviews	• Targeted-focuses directly on case study topic. • Insightful-provides perceived casual inferences.	• Bias due to poorly constructed questions. • Response bias. • Inaccuracies due to poor recall. • Reflexivity-interviewee gives what interviewer wants to hear.	• Semi-Structured interviews.
Direct Observation	• Reality-covers events in real-time. • Contextual-covers context of events.	• Time consuming. • Selectivity-unless broad coverage. • Reflexivity-event may proceed differently because it is being observed. • Cost-hours needed by human observers.	• Formal and informal meetings with the respondents for acquiring more insights.
Participant Observation	• [Same as above for direct observation]. • Insightful into interpersonal behaviour and motives.	• [Same as above for direct observation]. • Bias due to investigator's manipulation of events.	• Straightforward involvement.
Physical Artifacts	• Insightful into cultural features. • Insightful into technical operations.	• Selectivity. • Availability.	• Hardware and software tools.

Table 4.3: Six Sources of Evidence: Strengths and Weaknesses (Source: Yin 2009) and their Use in this Research

4.5.2.1 Secondary Data

This research makes use of secondary data as the first source of case study evidence as mentioned in the above table. Data triangulation is applied in this project in terms of data collection methods and data sources. Secondary data is already published data available at secondary sources which falls into both categories as it is one of the tools to collect data while opening many avenues for required information to investigator (Sekaran, 2003). The reliability and validity of the secondary data depends on the quality of the source and state of the data collectors. Secondary data in the context of time is first collected by other researchers as primary data (Gray, 2009; Saunders *et al.*, 2007). Hence, if it is from trustworthy source where researcher has received higher acceptance rate of his findings from the data then it can be considered reliable for other studies as secondary data. This thesis makes use of secondary data in two phases from various sources as highlighted in Figure 4.2.

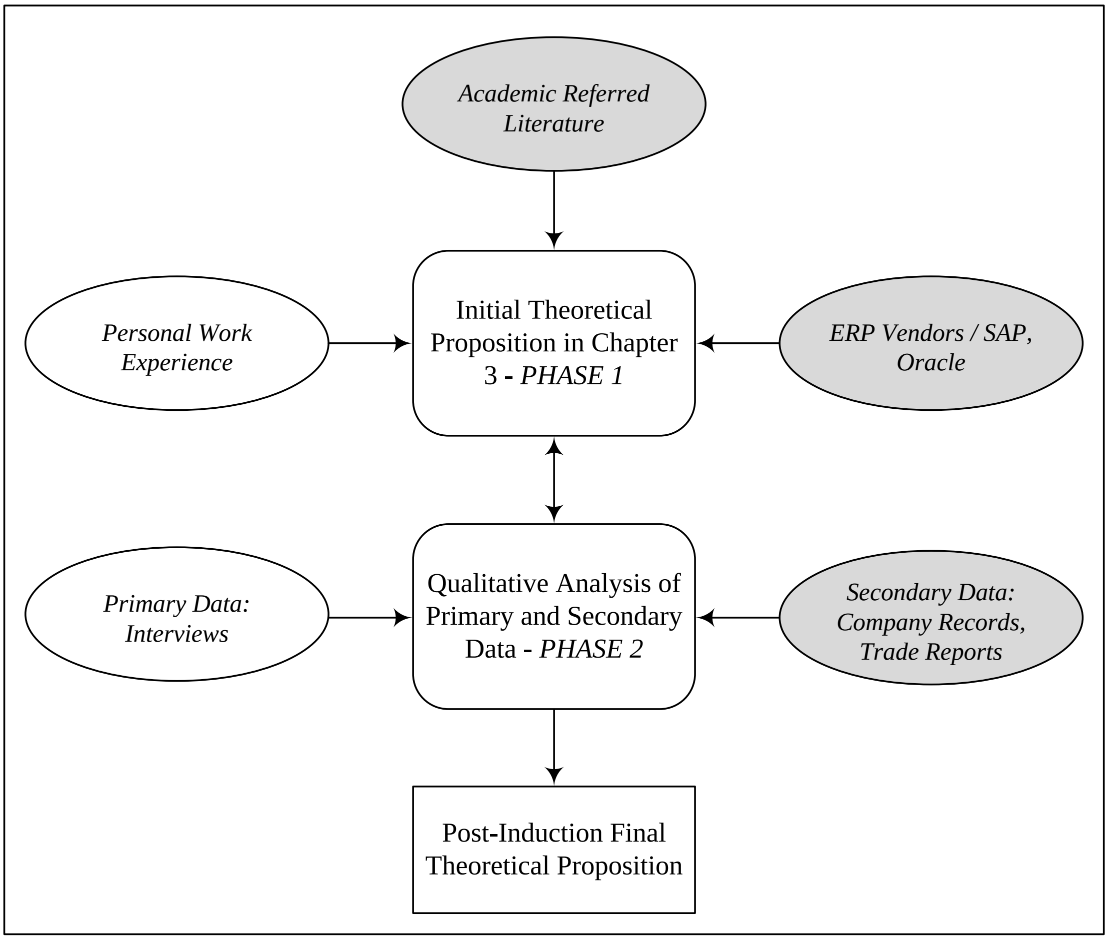

Figure 4.2: Influence of Secondary Data

Studying case company helps in deriving initial theoretical proposition. During second phase, secondary data is collected from case companies and trade organisations. Secondary data for this project is collected from academic literature, vendors ERP manuals, trade reports, online databases and government organisations websites. This list is indicative but not exhaustive since it can be ongoing process till completion of analysis. Compared to primary data time and costs are less consumed in collecting this type of data but researchers can get overloaded with unnecessary information which can increase the time consumption for categorising, coding and analysing such vast arrays of information to meaningful interpretations (Flick 1998). As one can see the quality of secondary data can significantly impact the findings of this project as it influences both ends of inductive approach and more quantity of secondary data is collected compared to primary data from and interviews. Over many advantages from this data source, they contain pitfalls on the issues like availability, access, relevance, sufficiency and accuracy (Gray, 2009).

4.5.2.2 Interviews

Interviews are considered as an important research instrument for data collection in the qualitative research and moreover, a main source of evidence in the case studies (Denzin and Lincoln, 1998; Gray, 2009; Yin, 2009). Interviews are more suitable when interpretations of actions, events, aspirations and opinions are required to be analysed in the research (Walsham, 1995). The three major categories of interviews are structured, semi-structured and un-structured interviews (Saunders *et al.,* 2007). In the context of this thesis, the author however, has selected one type of research instrument for primary data that is semi-structured interviews. Since, top management can reveal more information and discussion with them can bring unknown issues to the fore, it is very vital to use appropriate method to extract such information. To allow the discussion to reveal more relevant information and to decrease any researchers bias, semi-structured and face to face interviews are selected over the structured/ telephonic interviews. This may take the form of informal discussion regarding organisation's experience with use of ERP and implications occurred at different stages.

Semi-structured interviews are often applied for qualitative analysis such as this research study (Saunders *et al.,* 2007). Interviews are considered the best at exploring the information but they are a time consuming method as it takes too much time to arrange meeting with top management executives and approximate 7 to 8 hours for transcribing the answers (Gray, 2009). Use of electronic device to record the interview needs the permission of interviewee and operational ease of interviewer (Yin, 2009). The idea of using semi-structured interviews is about having flexible process where investigator and respondent understand the issues and event of discussion questions and talk is more open ended rather than closed and on extremes. The author selected two case companies for the primary data.

In this thesis, as reported two case studies were conducted with each case consisting of 10 interviews. However, initially there were about 25 to 30 potential participants identified from both the case studies (individually) for conducting interviews and validating the current conceptual model. Nevertheless, on approaching the participants the author realised and had to cut short the participant list to 10 interviewees for each case. The reason behind this reduction in interviewees' list was their individual knowledge on ERP systems, involvement in the ERP adoption and implementation process and above all, the 10 selected interviewees were decision-making in their own right with different leading responsibilities in the organisation. These 10 interviewees (for each case study organisation) were finally selected in order to understand different conceptions from their managerial capability perspective. These managers were directors of information technology, project manager, IT module managers and module managers spanning across both the case studies. Moreover, the inter-disciplinary nature and cross-functional managers have allowed the richness of data in terms of getting all possible views regarding what went into the ERP adoption and implementation in both case studies. This supported in understanding ERP adoption and implementation in its natural surroundings i.e. the case study organisations. However, the quality of the analyses was improved by selecting interviewees across the organisation as shown in Table 4.4. The inter-disciplinary or cross-functional managers have allowed the richness of data in terms of getting all possible opinions regarding what went into the ERP adoption and implementation in both case studies.

Case Study Organisation	**Interviewee Position**	**Type and Style of Conducting Interviews**	**Number of Meetings Conducted with Each Interview**
Case study – I	Director - Information Technology (D_IT)	All interviews were conducted in face to face manner with flexible process of discussion and answers.	2
	Director - Systems Applications (D_SA)		2
	Director - ERP Systems (D_ERPS)		4
	Project Manager – ERP (PM_ERP)		6
	IT Director – HR and Payroll Systems (DIT_HRPS)		1
	IT Director - Logistics Systems (DIT_LS)		1
	IT Director - Financial Systems (DIT_FS)		1
	Director - Human Resources Systems (D_HRS)		1
	Director - Logistics Systems (D_LS)		1
	Director – Finance Systems (D_FS)		1
Case study – II	Vice President - Information Technology (VP_IT)	All interviews were conducted in face to face manner with flexible process	1
	Director General – Systems (D_GS)		3
	Director - ERP Systems (D_ERPS)		4
	Project Manager – ERP (PM_ERP)		1
	IT Director - Human Resources Systems (DIT_HRS)		1
	IT Director - Logistics Systems (DIT_LS)		2

	IT Director - Financial Systems (DIT_FS)	of discussion and answers.	1
	Director - Human Resources Systems (D_HRS)		1
	Director – Logistics Systems (D_LS)		2
	Director – Finance Systems (D_FS)		1

Table 4.4: Interviewee Selection in the Case studies

The above mentioned interviews were not recorded as the author had template of the interview agenda. During the course of discussion, it was mainly filled by interviewees but in many cases the interviewer had to help them for mapping and prioritisation questions as Analytical Hierarchy Process (AHP) technique was new tool for many. The following is the brief outline of seven sections structure of interview agenda. The interview agenda summarised in Appendix C focuses on collecting data from the following sections:

- **Section A: Organisation Information:** This section attempts to collect general information related to the case studies under study. Such data include for example: *(a)* the status of the case study, *(b)* organisational chart, and *(c)* number of employees.

- **Section B: State of ERP in the Organisation:** This section collects details about ERP state of the case study e.g. current status of the ERP in the case study, what was the pre-ERP situation of the case study**,** integration process, efforts made and challenges faced by the case study previously.

- **Section C: ERP Adoption and Implementation Factors:** This section is very important as it displays importance of factors influencing ERP adoption and implementation, and BCOR analyses of ERP adoption and stakeholder analysis.

- **Section D: Prioritising of CSF in ERP Adoption and Implementation:** This section employs the AHP technique to precisely prioritise the factors from the most important to the least important.

- **Section E: ERP Lifecycle Phases:** This section extracts the details about lifecycle phases divided into three: pre-implementation, implementation and post-implementation, as overarching phases of the complete adoption and Implementation process.

- **Section F: ERP Lifecycle Stages:** This section includes details about ERP in terms of stages within the major phases defined in the previous section. Answers to this section reveal the importance of each stage and core activities carried out.

- **Section F – Mapping CSF in ERP Adoption and Implementation Lifecycle:** This section is vital to the primary data analyses as it collects responses of managers about mapping of factors critical for the success of ERP adoption and implementation. Section applies mapping of factors in a stage.

4.5.3 Data Analysis

In this thesis, data analysis in conducted in three steps: *(a)* secondary data analysis, *(b)* interviews data analysis for content, mapping and finally, *(c)* prioritisation using AHP. Each of these steps is explained as follows.

4.5.3.1 Secondary Data Analysis

This data is obtained from three major sources of data: vendors, case studies, trade reports. Each source of data provides different kind of information to the research and proves to be complementary to fill the gaps for required analyses. Such data obtained from various documents can be coded and categorised into tabular formats and then prepare the charts for pre-set concepts and research themes to find any pattern emerging from their trends. Coding patterns depend upon the type of research question and analysis problem. This particularly helps in reducing large amounts of data to smaller analysis units. These units lead the author to identify the schema of integrated and evolving patterns of different variables to make meaningful inferences (Miles and Huberman, 1994). These analyses can take various forms such as causal analysis, exploratory or descriptive analysis, explanatory or trends analysis using different types of data stream displays, for example matrices or graphs.

4.5.3.2 Interview Data Analysis

Interview data is in the form of answers to the questions asked by investigator to respondents. This data needs to be transcribed in a format suitable for further coding and categorisation. This process involves breaking and reducing the data to smaller units where it can reveal their salient elements, structure, pattern and characteristics. Qualitative analysis comprises of not only describing the data but explains the constituents of theory, linkages between concepts and classifying it further to create new relationships (Gray, 2009). This thesis uses content analysis technique for interview data. Flick (1998) explained three steps of content analysis as follows:-

- *Summarising the content analysis*: Grouping of similar textual material to eliminate less relevant data;

- *Explicating the content analysis*: Introducing the definitions of terms of removing any doubt from the reduced data, with the context of discussion into analysis; and

- *Structuring the content analysis*: Identifying the formal structures or emerging patterns from the coded data.

Content analysis is an important tool to analyse qualitatively the interview data but only disadvantage is that it does not offer associations and casual relationships between variables (Gray, 2005). This qualitative analysis would mainly consist of understanding the language, discovering any regularities and irregularities in the data, deriving the meaning of text or action and reflection. This allows the author to analyse the data in a systematic process which can lead to easy interpretations and induction of theoretical concepts (Saunders *et al.,* 2007). Hence, qualitative analysis using content analysis method for interview data is one of the most suitable methods in this context to deploy for interview data. In this thesis, the auther has applied content analysis; however there was no coding needed as interview agenda was prepared in detail. Based on this interview agenda, the content analysis was carried out for each research propositions discussing the feedback given by case study managers.

4.5.3.3 Selection of Analytical Hierarchy Process

In this section, the author introduced an appropriate technique (i.e. AHP technique) that possibly will support in prioritising the importance of factors influencing ERP adoption and implementation in SSOs. However, besides AHP technique there are a number of other techniques theorised in the literature and employed by several researchers to rank their factors e.g. Ranking Approach [RA] (Buss, 1983), Analytical Network Process [ANP] (Lee and Kim, 2000), mathematical optimisation i.e. non-linear programming model and 0-1 goal programming model (Badri *et al.*, 2001; Santhanam and Kyparisis, 1996), etc. The analysis of these techniques clearly highlight that they do not include the preference structure of the decision-maker(s). Preference structure is to describe the views and insights of decision-makers in relation to a single or multiple factors (Salmeron and Herrero, 2005). According to Kamal and Alsudairi (2009), these techniques and methods are not suitable in situations where the decision makers have no obvious preferences on the distinct factors, or when the attention is concentrated on acquiring technology that acts better autonomous of individual preferences. Moreover, the applicability of these techniques and methods is frequently undermined by complicated mathematical models or restricted characteristics to perform in a real world decision e.g. in the context of this research – ERP adoption and implementation decisions, particularly, where a number of factors are not promptly proven, and not straightforward for managers to comprehend. Conversely AHP technique supports in establishing the priority of a set of substitutes and the comparative importance of attributes in a multi-criteria decision-making problem (Saaty, 1980; Wei *et al.*, 2005). The comparative analysis conducted by Kamal (2008) clearly supports the fact that AHP is highly efficient and effective when coming to prioritising the importance of factors. This comparative analysis is presented in Table 4.5 – by summarising the characteristics of different techniques such as AHP, Simple Multi-Attribute Rating (SMAR), Data Envelopment Analysis (DEA), RA and ANP.

Characteristics Differentiating the Prioritisation Techniques	**Prioritisation Techniques**				
	AHP	**SMAR**	**DEA**	**RA**	**ANP**
Incorporation of preference structure	✓	–	–	–	–
Synthesised analysis of diverse judgements	✓	–	–	–	–
An intuitive technique	–	–	–	✓	–
Optimising resource allocation for interaction of factors	✓	–	✓	–	✓
Limited attributes to carry out real world decisions	–	✓	✓	✓	✓
Captures individual knowledge and experience	✓	✓	–	–	–
Gives easy understanding of problem situation	✓	–	–	–	✓
Time-consuming process	–	–	–	–	–
Non-linear representation	–	–	–	✓	–
Managing large amount of qualitative/quantitative data	✓	–	–	–	–
Applicability weakened by complex mathematical models	–	–	–	✓	✓
Easy understanding of the prioritisation process	✓	✓	–	✓	–
Quick insight into structure of information	✓	✓	–	–	–
Requires less skill and training	✓	✓	✓	✓	✓
Measure the performance efficiency of decision makers	–	✓	✓	–	–
Structures through symbolic and numeric representation	✓	✓	–	–	–
Supports different viewpoints through rich pictures	✓	–	–	–	–
Techniques not appropriate for all situations	✓	✓	✓	✓	✓
Too much focus on quantifiable calculations	–	✓	✓	✓	✓
Providing a step-wise guideline for prioritising the factors	✓	–	–	–	✓
Accessible data format	✓	–	✓	–	–
Graphical representation	✓	–	–	–	–
Resolves complex problems of choice and prioritisation	✓	–	✓	–	✓

Table 4.5: Characteristics Differentiating the Prioritisation Techniques (Source: Kamal, 2008)

As evident from the abovementioned analysis (Table 4.5), the author argues that AHP technique is essentially valuable and constructive that facilitates the decision-makers in articulating their specific preferences and deals with intricate problems of selection and prioritisation (Saaty, 1977). AHP technique is an adaptable decision-making technique that is employed to set priorities amid individual factors and resolving intricate decision problems (Saaty, 1980). This is because it enables the decision makers in selecting and highlighting that a particular factor is vital over the other factor. The decision makers can conduct the prioritisation through a step-wise comparison procedure (Saaty, 1980). Chin *et al.*, (1999) reports that by employing AHP technique, intricate decision related problems can be divided into numerous smaller sub-problems. Wei *et al.*, (2005) argued that the latter possibly can facilitate in reducing the evaluation prejudice.

AHP has been broadly employed in the IS field in order to reflect the importance, or weights, of the factors related to priorities (Khoo *et al.*, 2002; Wasil and Golden, 2003; Kumar *et al.*, 2010). AHP technique can be employed in qualitative, quantitative or even in mixed method approaches in order to solve decision problem. In the context of qualitative research methodology, an intricate decision problem is divided into a hierarchical structure, whereas, quantitatively, it adopts pair-wise comparisons to rank the decision elements (Cheng and Li, 2002; Khoo *et al.*, 2002; Wasil and Golden, 2003). Having discussed on the significance of AHP technique, Table 4.6 illustrates the core rationales for opting AHP technique in the context of this thesis research.

Rationale for Opting AHP Technique	References
• Employ of suitable measurement extent. • Developed in consistency tests. • Comprehensible data format. • User-friendliness and over- measurement of judgements.	Lai *et al.*, (1999); Saaty, (1980)
• Facilitates in reducing the evaluation prejudice.	Chin *et al.*, (1999)
• Offers an in-depth step-wise comparison procedure. • Capability to ensure reductions in discrepancies.	Jackson, (2001)
• Applicable to qualitative, quantitative and mixed method approaches.	Cheng and Li, (2002)
• Facilitates decision-makers in articulating individual preferences. • Flexible decision-making process to set priorities amid distinct factors. • Dividing intricate problems into smaller sub-problems.	Salmeron and Herrero, (2005); Saaty, (1997)
• Offers a flexible and simply comprehensible way of evaluating problems. • Facilitates subjective and objective factors deemed for evaluation.	Huang *et al.*, (2004)
• Synthesised evaluation of varied judgements. • Handles intricate problems of preference and prioritisation.	Lam and Chin, (2005); Saaty, (1994)

Table 4.6: Reasons for Selecting the AHP Technique *(Adapted: Kamal, 2008)*

Despite the significance of AHP technique, the author still does not assert that AHP is the finest option, however, there are a number of references backing the fact that AHP is paramount and can be employed to prioritise the factors based on their importance (e.g. Saaty, 1980; Chin *et al.*, 1999; Salmeron and Herrero, 2005; Kumar *et al.*, 2010). Therefore, the author uses the AHP technique in this thesis to prioritise the importance of ERP adoption and implementation factors. The author discusses on the basic steps of AHP technique to prioritise ERP adoption and implementation factors. The AHP technique encompasses four basic steps.

- **Step 1 – Constructing the Hierarchy Model:** *Initially*, the top level of the entire hierarchy represents the goal of the decision problem (Figure 4.3). This decision problem is divided into a hierarchy of interconnected elements. The elements in the middle level are the factors such as:

    - Stakeholder Category (Top Management Commitment (TMC), Project Champion (PC), Execution Team (ET), Qualified IT Staff (QITS), External Advisory Support (EAS), Vendor Partnership (VP) and Total End-User Involvement (TEUI));
    - Process Category (Business Process Reengineering (BPR), Customisation Approach (CA) and Performance Measurement and Control (PMC));
    - Technology Category (IT Infrastructure (ITI), Package Requirements and Selection (PRS), System Testing (ST), System Quality (SQ) and Information Quality (IQ));
    - Organisation Category (Business and IT Legacy Systems (BITS), Change Management (CM), Effective Communication (EC), Business Vision Goals and Objectives (BVGO), Training and Education (TE) and Organisational Structure and Culture (OSC)); and
    - Project Category (Project Management (PM), Budget – Cost Parameters (BCP) and Time (T)).

In this section, the hierarchy of the factors (Figure 3.2) was classified into three levels as depicted in Figure 4.3.

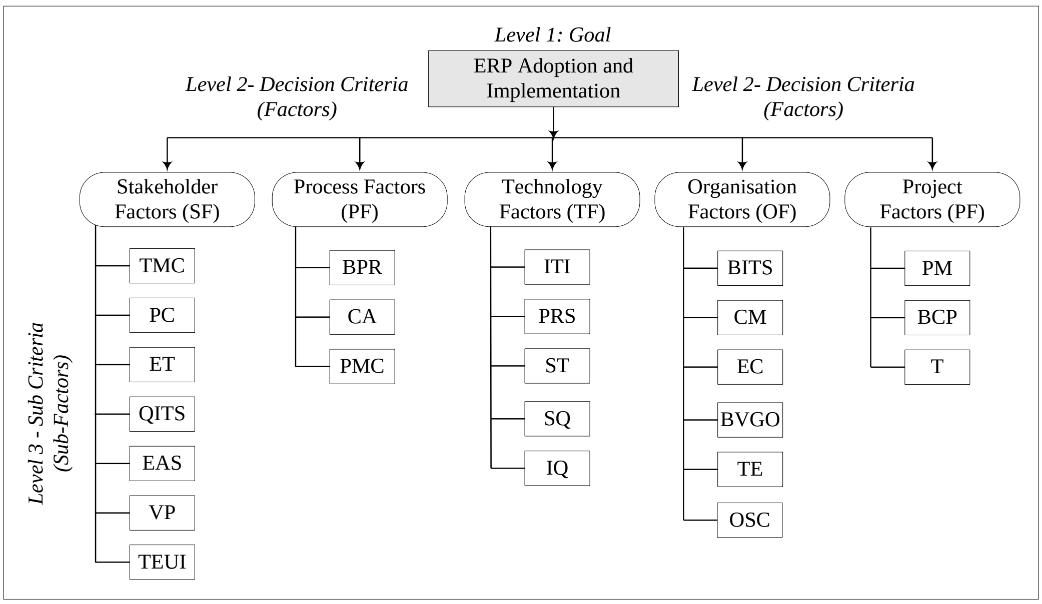

Figure 4.3: ERP Adoption and Implementation Factors Hierarchy Model

- **Step 2 – Collecting Data through Pairwise Comparison by Interviews:** *Secondly*, in the transitional level the data will be gathered by pair-wise comparisons by conducting the interviews. According to Yang and Huang (2000) this phase can be explained into three sub-steps.

  - *First Sub-Step:* The computation of different weights by enquiring the importance of each factor over other factors through pairwise comparisons.
  - *Second Sub-Step:* This comprises of the computation of a vector of priorities.
  - *Third Sub-Step:* This step measures the consistency of the rulings of the answers. In this step, the proposed ERP factors will be compared with other factors based on their importance within their individual designated category. Similar process is applied to all factors within all the proposed categories.

According to Salmeron and Herrero (2005) there are a number of ways in which comparision among the factors can be conducted and the number of them relies on the trust the top management places on the consistency of the human group being interviewed. Nevertheless, the author employed the extensively acknowledged nine-point scale as originally developed by Saaty (1977) to conduct a pairwise comparison of factors with the meaning of each of the values of the scale shown in Table 4.7.

Pairwise Comparison scale for AHP Preferences	
Numerical Rating	**Verbal Judgements of Preferences**
1	A is equally preferred over B
2	A is equally to moderately preferred over B
3	A is moderately preferred over B
4	A is moderately to strongly preferred over B
5	A is strongly preferred over B
6	A is strongly to very strongly preferred over B
7	A is very strongly preferred over B
8	A is strongly to very extremely preferred over B
9	A is extremely preferred over B

Table 4.7: Pairwise Comparison scale for AHP Preferences *(Source: Saaty, 1977)*

The process of pairwise comparisons is the core and fundamental to the AHP technique, regardless of use in different domains. Whilst comparing factors, a proportion of relative significance, inclination or probability of the factors can be developed. However, this proportion does not require to be based on some benchmark scale for example feet or meters but simply signifies the association between the factors. For instance, whilst conducting a comparison between any two factors, it can be judged (without any methodical dimension) that one factor may be more important over the other, or double as important as the other factor. This may be a prejudiced decision; however, the two factors can be compared per se. Researchers may have reservations on the precision of any decision made in the absence of any benchmark scale. Thus far, it has been established that several pairwise comparisons engaged together form a sort of average, the results of which are very accurate.

This "average" is computed based on a multifaceted geometric process by means of *eigenvalues* and *eigenvectors*. According to Forman and Selly (2004) the results of this method have been extensively experimentally tested and have been found to be particularly accurate. As mentioned earlier that though several ways of making the pairwise comparisons subsist, the most widespread method seeks from the interviewed group to provide a rate, w_{AB}, concerning the importance of a specific factor, A, in contrast to the importance of another factor (of the same category [as in this thesis] or in studies focusing on factors without defining any category), B. Thereafter, the reciprocal comparison, the rate of the importance of factor B over A, is worked out from the previous (and is given by $1/w_{AB}$). This method decreases the number of comparisons for the interview to n (n-1)/2, where n is the number of factors in a specific category. This process was proposed by Salmeron and Herrero (2005) and is adapted in the context of this research to identify the importance of factors in each category.

By employing this method, there are no symmetric discrepancies (i.e., the importance of B over A will always be steady with the importance of A over B). Nevertheless, the transitive property may not be hold (i.e., the degree of importance of A over B does not have to be consistent with the importance of A over C and C over B). Therefore, the likelihood of probable discrepancies has to be evaluated. As presented in Table 4.7, the author used the extensively acknowledged nine-point scale. The opposite but equivalent scale is used for B being preferred to A i.e. if for instance, "B is strongly to very strongly prefer over A", and then this rate indicates the importance of A over B as 1/6. It is vital to note here that this implies that zero cannot be incorporated in the scale for pairwise comparisons (1 is the middle of the scale, meaning equal preference of the two attributes being compared). As suggested by Salmeron and Herrero (2005) the mathematical values signifying the judgements of the pairwise comparisons are arranged in the upper triangle of the square matrix. For instance, a_{ij} symbolises how much criteria *i* is preferred over criteria *j*. This signifies that: $a_{ij} = w_i / w_j$. The elements in the main diagonal of A are all equal to 1 and the elements of the down triangle are the inverse of the elements in the upper triangle (i.e., $a_{ji} = 1/a_{ij} = 1/ (w_i/w_j) = w_j/w_i$). Each of its elements, a_{ij}, is the ratio of the absolute weight relative to the importance of criteria *i* over the absolute weight relative to the importance of criteria j. The matrix (as adapted from Salmeron and Herrero, 2005) becomes: $A = (a_{ij})$, $(i, j = 1,\ldots, n)$; A

$$= \begin{bmatrix} 1 & \ldots & a_{ij} \\ \ldots & 1 & \ldots \\ 1/\,a_{ij} & \ldots & 1 \end{bmatrix}$$

That is:

$$= \begin{bmatrix} 1 & \ldots & w_i/w_j \\ \ldots & 1 & \ldots \\ w_j/w_i & \ldots & 1 \end{bmatrix}$$

The elements of the abovemented matrix reveal the importance of each factor over other factor. Nevertheless, the author is concerned in identifying the value of the weight of each factor in itself (the vector of priorities), not the weights when compared to other factors (this is achieved in the next step of the analysis). Moreover, this matrix verifies that: $Aw = nw$, where w is the vector of the actual absolute weights and n is the number of criteria. The author uses the abovementioned equality to get the weights of each factor. According to Saaty (1977) it has been proved that n is the largest eigenvalue of matrix A and that the vector of weights the author is looking for is the eigenvalue associated to this value. These weights are referred to as the local weights, i.e. the weights within the category the factors belong to. Salmeron and Herrero (2005) argue here that if there is an upper category, then the absolute weights are given by multiplying the weight of the attribute above by the local weights. By doing this, the author can get a normalised set of weights for all the factors in the lower category.

Therefore, the author requires calculating the eigenvalues of this matrix consider the largest one and calculate the associated eigenvector that would be the relative weights the author is seeking for. The calculation of eigenvalues and eigenvectors is a straightforward and widespread method in mathematics. This can also be calculated using mathematical software Expert Choice for computing the categories' weights. These weights must verify that: $Aw = \lambda_{max}w$, where λ_{max} is the largest eigenvalue of A and w is the eigenvector associated to that eigenvalue. The value $\lambda_{max} = n$ should always be the largest eigenvalue of A. Nevertheless, discrepancies in the answers of the people interviewed may lead to a different value i.e. closer to n, the greater the consistency of the answer. A normalised consistency ratio, based on the divergence of the largest eigenvalue to n, is commonly used in the literature (Zahedi, 1986). The closer the consistency ratio is to zero the greater the consistency of data results. As was stated before, the equality $a_{ij} = 1/a_{ii}$ holds by construction. The answers are consistent if the equality $a_{ij} \cdot a_{jk} = a_{ik}$ holds for all factors.

Explicitly, if the transitive property holds (the preference of A over B is equal to the preference of A over C times the preference of C over B).

If this correspondence does not held for a given top management official, it signifies that the official is not steady in his/her statements and thus it is required to conduct the interview again. In practice, the weights are considered valid if both terms of the equality do not differ much; or else the answer of the official under analysis is either eradicated from the dataset or the questions regarding the attributes involved in the equality have to be redone. According to Zahedi (1986) the maximum accepted upper value for the consistency ratio is 0.1 for the data to be accurate. This measure of consistency can be used to evaluate the consistency of decision-makers and the consistency of all the hierarchy (Yang and Huang, 2000).

- **Step 3 – Determining Normalised Priority Weights of EAI Adoption Factors:** *Thirdly*, establishing normalised priority weights of individual ERP adoption and implementation factors and lastly, evaluating and estimating the priority weights. Decision elements at each hierarchy level are compared pairwise and are assigned relative scales that reflect the strength with which one element dominates another.

- **Step 4 – Analysing and Calculating the Priority Weights:** *Fourthly*, derived from these pair-wise comparison matrices, local and global priority weights are established and the ranking of the alternatives at the last level of the hierarchy are made to satisfy the overall goal of the problem (Chin *et al.,* 1999).

4.6 Data Triangulation

Authenticity and homogeny of the pragmatic research findings is another fundamental issue that concerns interpretive researchers. Triangulation is the term that is related with such issues – a way to validate the results (Denzin, 1978). According to Denzin (1978), triangulation is of four types, such as: *(a)* data, *(b)* investigator, *(c)* theory and, *(d)* methodological, while, Janesick (2000) further added a fifth type referred to as interdisciplinary triangulation. These types of triangulations are interpreted as follows:

- Data triangulation signifies the employment of diversity of data sources in a particular research study (Denzin, 1978),

- Investigator triangulation refers to the employment of different researchers or evaluators (Janesick, 2000),

- Theory triangulation is about the employment of manifold conjectural viewpoints to explain a particular set of data (Denzin, 1978),

- Methodological triangulation signifies the employment of numerous methods to study a particular predicament, and

- Lastly, interdisciplinary triangulation is refers to the examination of problems with regards to multiple areas (Janesick, 2000).

In the context of this thesis, it can be deduced that data, methodological and interdisciplinary triangulation are being used in this research, as illustrated in Table 4.8.

Service Organisation	Type of Triangulation Applied	Sources	
Case Study – I	Data	• Reports, • White papers • Interviews	• Organisational records • Observations
	Methodological	• Documentation • Archival records	• Interviews • Observations
	Interdisciplinary	• Information Systems	• Management • Culture
Case Study – II	Data	• Reports, • White papers • Interviews	• Organisational records • Observations
	Methodological	• Documentation • Archival records	• Interviews • Observations
	Interdisciplinary	• Information Systems	• Management • Culture

Table 4.8: Types of Triangulation Used in the Research

4.7 Case Study Protocol: An Operational Action Plan

Case study research strategy is considered one of the very complex and difficult procedures to be carried out in the research field. It needs a skills set from investigator like being adaptive to situations, good listener to respondents and flexible to changing conversations and knowledgeable to ask good questions (Yin, 2009). This leads one to strengthen the quality of case study in terms of reliability and validity. Hence, maintaining the protocol in case study research is very crucial and desirable especially when the author is applying either multiple cases or multiple units of analyses.

4.7.1 Case Study Overview

The aim of this research is to contribute in the field of ERP adoption and implementation so that industry practitioners have higher success rate in utilising this innovative system. To enable this, the author has taken an approach to review each category of the phenomena (i.e. ERP). Main objectives to be carried out comprise various analyses of theories associated to ERP adoption and implementation, ERP critical success factors, prioritisation of factors, lifecycle phases and stages and mapping of factors across the ERP lifecycle stages. Literature review in Chapter Two and theoretical proposition in Chapter Three provides main issues to be addressed as follows to collect rich and robust data:

- To identify the ERP adoption and implementation process used by the case study,
- To identify factors influencing ERP adoption and implementation,
- To prioritise the importance of factors influencing the decision-making process for successful ERP adoption and implementation,
- To identify different lifecycle phases and stages comprising of relevant activities of ERP adoption and implementation,
- To map factors influencing ERP adoption and implementation on different lifecycle phases and stages, and
- To identify the appropriateness of these factors in a conceptual model for ERP adoption and implementation in SSOs.

4.7.2 Fieldwork Research Procedures

The data collection process is divided in the major phases, such as:

- Prepare the final research instrument (Appendix C).
- Collection of secondary data from both the case studies,

- Selection and contact to key personnel in both the case studies (top managers, IT managers and non-IT managers), and
- Collection of primary data from both the case studies.

The primary data was collected through semi-structured interview process and the interview agenda (as presented in Appendix C) was explained in the telephonic conversation to the participants prior to meeting them face-to-face. The data collected does not include any personally identifiable information from any executive from both the case studies. The interview agenda is divided into six sections of:

- Organisation information,
- Organisation's ERP status,
- Investigation of ERP adoption and implementation factors,
- Prioritising the importance of ERP adoption and implementation factors,
- ERP lifecycle phases and stages, and
- Mapping ERP adoption and implementation factors.

The data was collected through multiple sources such as interviews, organisations' websites, documentations and archival records of the case studies. The author initially contacted more than 25 to 30 executives as potential participants from each case study, however, due to time constraints, lack of knowledge on ERP systems, and busy schedule of most of the potential participants and the time required to interview each participant, the author managed to interview 10 participants from each case study. Most important reason for not being able to focus on another case study was the culture. It is a general phenomenon is this country that it is hard to get time from the executives due to their nature. This aspect also affected the author is focusing on more than 10 interviewees from the existing case studies.

4.7.3 Questions Addressed by Interviewer

These set of questions are for interviewer and not for respondents as they are structured keeping the main aim, objectives and research questions in the sight. The main advantage of preparing this set of questions is to keep a reminder for researcher during the course of data collection. For example, keeping note of this during interview, researcher can take back the control of discussion and know that what should be the next question to be asked after each response. This would immensely increase the richness of description and reliability of the data collected. Questions crucial for research theme are tabulated in Table 4.9.

Proposed Research Areas and their Relevant Questions for Further Investigation	
Research Area	**Description of Research Question**
ERP Adoption and Implementation Factors	• What are the factors that influence the decision-making process for ERP adoption and implementation in SSOs?
Prioritising the Importance of Factors	• What is the importance of each factor over the other factors influencing ERP adoption and implementation process?
Adoption Lifecycle Phases	• What are the different phases of the adoption lifecycle for ERP adoption and implementation process?
Mapping of Factors	• What factors influence ERP adoption and implementation at each stage of the adoption lifecycle?

Table 4.9: Research Questions Addressed by the Empirical Inquiry

4.7.4 The Research Output Format

In view of the fact that huge amounts of data are collected through the secondary and primary data from the case studies, the output format and analysis would be useful. The author added the interview agenda (Appendix C) with the research questions (Table 4.9). This approach offers quality to the research output in order to organise the huge amount of data. The case study output format is presented as Case Study 1:

- Background to Case Study
- ERP Project Process
- State of ERP
- Assessing the Research Propositions:
    - Assessing Research Proposition 1: Factors Influencing ERP Adoption and Implementation.
    - Assessing Research Proposition 2: Prioritising the Factors Influencing ERP Adoption and Implementation.
    - Assessing Research Proposition 3: ERP Lifecycle Phases and Stages.
    - Assessing Research Proposition 4: Mapping the Factors Influencing ERP Adoption and Implementation on Lifecycle Stages.

4.8 Conclusion

This chapter presented the rationale describing the selection and justification for the use of an appropriate set of research methods. This created a blue print to execute the research further and provided the author with a robust framework of research design. The author has justified selection of each method in terms of research philosophy, approach, strategy, data collection and data analysis. The selection included interpretivism philosophy, qualitative analysis, and inductive approach whilst applying case study research strategy. The primary data was collected by interviews and AHP technique was applied for prioritisation of critical success factors of ERP adoption and implementation. The data analysis was carried out using qualitative analyses of secondary and interviews data based on the research questions. Chapter Five presents the overall empirical work carried out as part of this thesis in order to validate the conceptual model proposed in Chapter Three.

5

Chapter Five: Research Analysis and Findings

5.1 Introduction

In the previous chapters, the author justified the research context (Chapters One andTwo), proposing a conceptual model for ERP adoption and implementation (Chapter Three), and warranted and analysed the research methodology (Chapter Four) employed in this thesis. The research work carried out hitherto needs to be further validated to establish its credibility. This chapter, as a result, applies the research methodology to test the proposed conceptual model (Figure 3.5) for ERP adoption and implementation in the KSA service sector. In doing so, the author presents and analyses the empirical data collected from two SSOs from the KSA region. The analysis of the empirical findings is derived based on the results of the secondary and primary data collected by the author. The analysis of the empirical findings forms the basis for finalising the conceptual model and offering further recommendations for appropriately adopting and implementing ERP systems in the KSA service industry. The author conducted two case studies from the KSA region, as this was found to provide enough information that assisted and supported the author in justifying and validating the research presented in this thesis.

Within these two case studies, the author conducted detailed semi-structured interviews with ten participants from each case study. The secondary data were collected from organisations' official websites, annual reports and white papers. The two case studies are studied in a way that both cases can be thoroughly compared for examining the state of ERP adoption and implementation. In addition, research propositions defined in Chapter Three namely, *(a)* factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* ERP adoption and implementation phases and stages, and *(d)* mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages, can be tested. ERP adoption and implementation practices from both the case studies are analysed in this chapter based on the proposed model (Figure 3.5). This analysis provided an understanding of how ERP is adopted and implemented in the practice as compared to what is stated in the literature (i.e. the author's conceptual findings in Chapter Two and Three). This further evaluates the feasibility of adopting and implementing the proposed model (Figure 3.5) in the service sector of the KSA region. Based on the empirical work carried out in this chapter, the author asserts that selecting a third case study could have given marginal benefits to this work. However, as discussed at the end of this chapter, this was seen to be likely.

5.1.1 Chapter Objectives

The main objective of this chapter is to implement the research plan by collecting data, analysing the findings generated from the results obtained from data interpretation. This process of research plan supports the validation of the proposed conceptual model (Figure 3.5), as this in turn responded to the research propositions (Table 3.1) in detail. These research propositions encapsulate the research objectives and main research aim of the study. These research propositions cover different constructs embedded in the ERP adoption and implementation process leading to theoretical underpinning of the ERP to organisational objectives and business processes. In addition, analysis within this chapter generated the debates from any differences noted between theoretical proposition and practical implementation of ERP by the two case studies.

5.1.2 Chapter Structure

Initially, the author presents the background to the case studies in Sections 5.2.1 and 5.3.1. Thereafter, in Section 5.2.2 and 5.3.2 the author exemplifies the ERP project process for the case studies. Followed by, Sections 5.2.3 and 5.3.3 the author discusses state of ERP for the case studies. The whole of Sections 5.2.4 and 5.3.4 (i.e. including Sections 5.2.4.1, 5.2.4.2, 5.4.1.3, 5.4.1.4, 5.3.4.1, 5.3.4.2, 5.2.4.3, and 5.3.4.4) provides in depth analyses of four dimension *(a)* factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* ERP adoption and implementation phases and stages, and *(d)* mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages, emerging from primary data for the case studies. In Section 5.4 the author compares the overall findings both the case studies. Finally, Section 6.5 concludes this chapter.

5.2 Case Study One (SSO_I)

Due to confidentiality reasons, the author agreed to maintain the privacy of participants who acted as the interviewees and the organisation. Henceforth, the SSO_I, which is part of the transport and aviation industry in the KSA region, will be termed as SSO_I.

5.2.1 Background to SSO_I

SSO_I is one of the leading airlines in the Middle-East region and a market leader in KSA. Apart from the major function of e.g. passenger traffic, the airline has other six business divisions, such as: cargo, catering, ground handling, training, marketing and information technology. The airline employs more than 25000 employees worldwide and is operating since 1946. It has fleet of more than 150 airplanes comprising the latest versions of Boeing and Airbus. It has more than 50 offices around the globe in **E**urope, **M**iddle **E**ast, **A**sia and **A**merica (EMEAA). This airline offers tour planning, ticketing and all required functions online through its corporate portal. It carries more than 20 million passengers and more than 225,000 metric tons of operational cargo annually. In addition, SSO_I is operating in collaboration with a variety of other service providers such as: transporters, cargo, holiday operators, hotels, car rentals and restaurants.

The Government of the Kingdom of Saudi Arabia intended to privatise the SSO_I as part of an overall economic reform program in the country. The privatisation process for SSO_I started in the year 2000, whereas, in January 2004, the privatisation strategy was defined that resulted in restructuring the organisation in 10 Strategic Business Units (SBUs). SSO_I deployed the front line technology in the form of SAP modules for ERP, SRM and CRM with more than 250 loops and thousands of employees in the IT division. Furthermore, SSO_I needed to compete with the external market forces, such as: competing with other similar business organisations locally (KSA), regionally with other Gulf Cooperation Council (GCC) countries, and globally with multinational airlines. In addition, low cost business organisations and services are being launched and established with aggressive expansion plans.

For latter these reasons, SSO_I intended to segment its target market into four core segments, such as: Low Cost Domestic, Regional/International Flag Segment, Religious Charter Segment, and Royal/VIP Segment. To perform the task of restructuring, SSO_I focused on ERP systems, as mentioned in the current and future state organisational structure below. In an attempt to better understand SSO_I and before analysing the primary data, the author discusses the current state of ERP adoption and implementation at SSO_I. The current ERP state indicates that its implementation plan is stemming from the technology strategy, and its technical infrastructure and objectives illustrate the ERP readiness of the SSO_I.

5.2.2 ERP Project Process

The worldwide increase in competition, open market policies by different governments and technological innovations have developed the airline industry into a complex and dynamic business environment. In such a competitive environment, end-to-end planning has to be comprehensive and decisions need to be made promptly. This clearly indicates the need for integrating various components of its business processes (in support of adequate resource allocations) and organisational infrastructure, in order to sustain a competitive position and business advantages. In such a situation, the engagement between IS and strategic planning process also becomes a crucial link. In addition, there is lack of a holistic view of IT, as every unit in the organisation attempts to receive help from IT department for various issues on the existing installed modules. This increases downtime, costs of the business, further generates difficulties in budgeting, resource allocation, strategy planning and overall business transactions processing. Solution to such problems has been sought in designing and implementing ERP modules, which requires the complete understanding of issues such as benefits, requirements and drivers of strategic IS or new technology adoption. The presence of ERP creates the right environment for integrated strategic planning with attention to technology as a backbone in the system. To strengthen the business functions, decision making, governing information and mapping functionality to service, SSO_I has started to avail services from SAP company modules having ERP, SRM and CRM in the business intelligence segment.

5.2.3 State of ERP

To understand the research issues related to the ERP adoption and implementation, it is essential to analyse and review specific concerns from organisational and its employees’ point of view. The state of ERP at SSO_I is analysed in terms of at what stage the organisation is in terms of adopting ERP, pre-adoption readiness for ERP, learning from the previous efforts to deal with such technology, process chosen to integrate the existing systems and any limitations which can further affect the implementation process. SSO_I adopted ERP from SAP Arabia and consortium of suppliers. The budget was approximately 180 million Saudi Riyals with an annual maintenance budget in the range of 20 to 25 million. SSO_I adopted a phased approach to implement ERP in the different departments and throughout the business operations. The feedback from middle managers and operational level executives suggest the successful running of operations through ERP. However, they are yet to realise the benefits of ERP in the tangible terms and move to the advanced stage of having ERP in the form of single frame 'business enterprise one' technology from SAP instead of current ERP in the form of different integrated functional modules. The advancement of technologies and customer centric business dynamics of airline industry have increased competition and complexities in this business segment. To stay competitive and profitable in such scenario, SSO_I needs to focus on comprehensively synchronising their planning and operational processes. Thus, information system has become a strategic issue for SSO_I, which supports the needs and motivation to adopt ERP. The infrastructure also required up gradation in the SSO_I prior to ERP since they did not have an integrated IT infrastructure under the existing organisational structure and management.

5.2.3.1 Pre-ERP IT Infrastructure

The organisational structure as explained in previous sections is centralised and still follows top-down command chain. Prior to the implementation of ERP, SSO_I's IT infrastructure was not unified and was based on the un-integrated multi-systems. However, SSO_ I's systems were based on the mainframe with multiple applications such as finance, human resources, aviation, ticketing and reservation systems, in addition to supporting applications. The interfaces between these systems were built on one-to-one ad-hoc relationships. To rectify issues arising out of such infrastructural problems, SSO_I undertook the initiative of restructuring the entire IT infrastructure. The IT restructuring is targeted to build new end user applications and processing in the areas of solution design, engineering and managed services which can support the future expansion and updates of IT platforms. The first phase of SAP ERP deployment was in the departments of corporate planning, marketing, operation and e-business systems. The ERP was adopted to integrate existing and new systems required based on the organisational restructuring plan. The new landscape of ERP implementation in the organisation has been discussed earlier in the section which planned to decommission the existing mainframe system.

5.2.3.2 Restructuring Efforts and Integration Process

The earlier legacy systems at SSO_I were not appropriately congruent and compatible with organisation's targeted objectives. Therefore, efforts were required to make the system compatible with new developments targeted. However, the new initiative to change the landscape of IT systems have completely changed the scenario of the developed infrastructural capabilities while not having any compatibility issues. It was possible for SSO_I to convert and update existing systems to utilise with new modules such as "Amadeus" for ticket reservation. To realise the benefits of these efforts in creating new integrated and structured organisational IS, SSO_I adopted business process view for infrastructure improvements and organisational restructuring, which is evident from new business structure and ERP design. In addition to this, SSO_I had another project ongoing with IT integration and infrastructural development that was privatisation of the company with changes in organisational structure and new recruitment drive. Hence, ERP adoption project was perceived to align with these changes through a proper change management process. The ERP in itself is a system of many integrated modules. However, it was necessary to integrate new ERP system with existing modules such as Amadeus. Before finally activating these planned actions of integration process and organisational restructuring, following pre-implementation limitations were required to overcome at SSO_I.

5.2.3.3 Pre-Implementation Limitations

Prior to adopting ERP systems and improving existing IT infrastructure, there were no appropriate communications channels within SSO_I. There were concerns about how to manage large cross functional teams and escalating the usage of new system. The major limitation was the lack of talented and experienced users because the middle and operational level employees were not having the required IT skills at high or proficient level in relation to ERP. Therefore, in-house development of such human capital was not possible and hence, the entire ERP installation and training were outsourced from a consortium of suppliers such as SAP, IBM and Atos Origin. The development by consortium also found resistance within organisation as SSO_I have a traditional management style of top – down command hierarchy system in place. This made it difficult to delegate the tasks and to cascade the new ERP system down the management levels. Having no prior technical experience was another barrier that hindered the implementation process. The pre-ERP status of entire IP based network infrastructure including data centre and servers were not sufficient to run the ERP systems. The migration to new data centre had taken place prior to ERP adoption and design. SSO_I adopted a phased approach for managing these data centre and ERP migration.

Some of the functional areas did not have well defined business processes, which resulted in making the ERP planning and design process difficult in the initial phase. In addition to this, there was lack of direction and governance across the firm in the functional roles and responsibilities that increased the operational ambiguity. Other causes to these issues can be attributed to unreasonable expectations of users for the systems to perform every task and part of pre-requisite business process not being ready. To solve existing concerns and development issues for staying competitive, it was the appropriate for SSO_I to adopt ERP to integrate their business processes and provide all in one solution for overall improvement of the organisation. Particularly, it solved the issues of performance measurement, industry benchmarking, hierarchical issues, raw material and resources allocation. ERP turned out to be the most seamless, reliable and integrated system which can be accessed 24x7 and provided top management with up to the minute report.

5.2.4 Assessing the Research Propositions at SSO_I

The earlier discussions provided the current state of ERP at SSO_I based on the secondary published data and managers' responses. The following assessment provides in depth analys of four dimension e.g. *(a)* factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* ERP adoption and implementation phases and stages, and *(d)* mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages, emerging from primary data. This assessment is done based on the research propositions described in the introduction, initial theoretical proposition and methodology sections. Table 5.1 outlines the research propositions to be further investigated in this chapter.

Research Propositions	Section in the Interview Responses	Contents Analysed in the Discussion
Research Proposition 1 – as highlighted in Section 5.2.4.1	Section C	Factors Influencing ERP Adoption and Implementation Process.
Research Proposition 2 – as highlighted in Section 5.2.4.2	Section D	Prioritising the Importance of Factors Influencing ERP Adoption and Implementation.
Research Proposition 3 – as highlighted in Section 5.2.4.3	Section E & F	Phases (Section E in Appendix C) and Stages (Section F in Appendix C) of the ERP Adoption and Implementation lifecycle.
Research Proposition 4 – as highlighted in Section 5.2.4.4	Section G	Mapping the Factors Affecting ERP lifecycle Stages.

Table 5.1: SSO_I Research Propositions

5.2.4.1 Assessing Research Proposition 1: Factors Influencing ERP Adoption and Implementation

This section presents the empirical findings on different propositions and factors influencing the ERP adoption and implementation process at SSO_I.

5.2.4.1.1 ERP Adoption and Implementation Issues

The following analysis of SSO_I pertains to the assessment of adoption and implementation issues in terms of people involved, value of ERP as a product, business process of the company (3Ps model) and its organisational and infrastructural frames.

People: The idea to spend SR180 million was from top management who proceeded to put forward organisational and technology restructuring proposal through director general of the SSO_I to the management committee. The proposal was based on the various studies conducted for competitive and needs analyses for the SSO_I. The involvement of all direct stakeholders in the adoption and implementation decision reduces the chances of any dispute or conflict over resistance, resources and implementation process at a later stage in the ERP. At the same time involving all the stakeholders may create complications from the initial phase. Hence, it would be advisable to make a cross functional team which can be supportive to top management in the decision making (Dawson and Ovens, 2008).

Most of the managerial responses suggest that SSO_I adopted a top-down approach of cascading ERP implementation. On contrary in reality, it is the end users which use ERP first and then results are derived at the upper echelons of the organisational level. Top-down approach in SSO_I is reflected in managerial responses to priority levels for different stakeholders in ERP implementation. All respondents rated the four targets areas based on the four priority scale with 1 being very important and 4 being less important (as highlighted in Table 5.2). Managers gave the highest priority to top management and project team ahead of end users. Top management need ERP for future decision-making and have control over resources, communications and approvals to make changes when required (Loh and Koh, 2004; Arnold, 2006; Ngai *et al.*, 2008). The project team is trained so each member is familiarised with the complete ERP design and functioning so they act as a backup to the organisation. Project team, readiness to accept change and top management commitment are important input for the easier implementation of ERP because incompetency with organisational inertia can take the whole project into chaos.

	INTERVIEWEES AND THEIR RESPONSES										**Average of 10**
Stakeholders	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	
Top Management	2	2	1	1	1	1	2	1	1	3	1.5 (1)
Project Team	3	1	2	2	4	2	1	2	2	4	2.3 (2)
End Users	1	4	3	3	2	3	4	3	4	1	2.8 (3)
Vendors & External Advisors	4	3	4	4	3	4	3	4	3	2	3.4 (4)

Table 5.2: Stakeholders Priority at SSO_I

End users could have been at the top because they are the actual users and the largest community to interact with ERP. The ease in their usage of ERP is critical for the overall organisational success (Kansal, 2007; Upadhyay *et al.*, 2011). Vendors are external advisors who have limited role in the post-implementation, once the project team is fully trained and post Go Live ERP is functioning well for the SSO_I.

Product: When one considers ERP as a product, its availability or implementation in the SSO_I can be analysed in terms of what benefits this case study would derive from ERP, costs contained in implementing ERP, opportunities that would be generated by and potential risks of ERP adoption. Table 5.3 highlights a detailed analysis based on the responses received from the managers.

Benefits (B)	Costs (C)
• Increased productivity because of the integration of all back office systems. • Competitiveness increased due to seamless systems. Automation, cost savings, collaboration, easy and retrievable documentation. Business process control, data consistency. • ROI, Process optimisation, Industry best practices, transparency to top level management.	• Only costs increases are in terms of capital outlay of buying ERP in SR 180 million and recurring maintenance costs with training for SR 20 million per annum. • This should have much smaller compared deriving economies of scale and scope by adopting the ERP.
Opportunities (O)	**Risks (R)**
• ERP will allow regaining the market share in the air travel industry. • Understanding and analysing the costs centres and profitability whilst to know who does what in the company. • The process of optimisation can allow making the best use of human capital as employees become multi-skilled and can be rotated between the jobs and different functional departments.	• Internal resistance from the employees can lead to the disruption. • Lack of adaption to new system and no motivation to compete. • Non-utilisation of all available functions of ERP. End users resistance and problems in the integration where there is system – client – user interfaces exist.

Table 5.3: BCOR Analysis of ERP as a Product for SSO_I

Process: The business process view of the ERP adoption and implementation helps in the project blue print in the first place. It also allowed managers at SSO_I to separate between factors which can have positive and negative impacts and factors critical for the successful ERP adoption and implementation. It was observed by the SSO_I managers that core critical success factors during the ERP adoption and implementation process are commitment from all involved business units, timely resources allocation, flexibility of reengineering processes to match the best practices, complete business process view, top management support, training to employees by vendors, and relations with consultants' consortium. The factors that have negative impacts on the ERP adoption and implementation process are mainly short time frame for installation, being over-reliant on the selected suppliers in the region, and employee resistance to changes in the organisational hierarchy and technological platform. On the other hand, those factors that positively influenced the ERP adoption and implementation process are logical method of selection and better integration, and co-ordination between stakeholders and required resources allocation. The major advantages for SSO_I from ERP adoption and implementation process included:

- Capabilities generated through use of ERP to streamline entire business process,

- To replace obsolete systems,
- To generate a quick return on the investment, and
- Overall scalability of the implemented solutions.

Organisational Frame: The organisational frame consists of intangible resources of strength within the company required for ERP implementation. The factors which can affect the operations within this frame are support from the top management, outsourcing from the international quality suppliers and use of skilled resources. The working of organisational frame depends upon the activities of employees and in turn their business knowledge and the sponsor's support. The human capital availability is in the form of internal team of project implementers and external team from suppliers and advisors comprising experienced SAP consultants. Dynamics and coherence between these teams is very crucial for sustainability of improvements made by implementing ERP (Nah *et al.,* 2000; Nah and Delgado, 2006).

Infrastructural Frame: The infrastructural frame consists of tangible resources that need to integrate ERP with the rest of the organisation. For example, the company has worldwide office network which requires a common platform and integration between main data centre, servers in and outside KSA and access to Internet gateways. Hardware, software and networks were required updating when SSO_I decided opt for ERP adoption (King and Burgess, 2006; Kamal, 2008). All these attributes of managing ERP adoption and implementation in the form of people, product and processes with support of tangible and intangible resources are very important and complementary to each other for the successful outcome of ERP.

From the analyses of responses regarding adoption and implementation issue, it emerges that *stakeholders' satisfaction* is the main criteria for measuring success of ERP. Ensuring the complete satisfaction of stakeholders provide the indirect measurement of how ERP is functioning overall and feedback about the technical components of ERP. Whether management decides to measure the stakeholders' satisfaction or not, stakeholders are still having positive or negative impacts from ERP adoption and implementation. This is true because eventually the stakeholders are the owners, drivers and end beneficiaries of the implemented solutions and their satisfaction and content means that the implementation was able to cover their quest for and all in one integrated solution. Hence, this fact makes the stakeholders feedback about ERP the most important criteria to measure the outcome of ERP adoption and implementation.

5.2.4.1.2 Factors Influencing ERP Adoption and Implementation

This section highlights the importance of factors based on Miles and Huberman's (1994) scale of high (●), medium (⦿) and low (○). During the interview, each participant was asked to highlight the significance of these factors in their specific context. Results as highlighted in Table 5.4 are based on the general discussions carried out during the interview. The author noted the responses for each factor from each interviewee and later, using the Miles and Huberman's (1994) scale, transcribed (as presented in Table 5.4). Where the interviewees have not responded, the author has termed it as not applicable by using the symbol as '×'.

		INTERVIEWEES AND THEIR RESPONSES									
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**
Stakeholders	Top Management Commitment	●	●	●	●	●	●	●	●	●	●
	Project Champion	⦿	⦿	○	⦿	○	●	●	●	●	●
	Execution Team	●	⦿	⦿	●	●	●	●	●	●	●
	Qualified IT Staff	●	⦿	⦿	●	●	●	●	●	●	●
	External Advisory Support	●	●	○	⦿	⦿	⦿	⦿	⦿	●	●
	Vendor Partnership	●	●	○	●	●	⦿	●	●	●	●
	Total End-User Involvement	●	●	●	●	⦿	⦿	●	●	●	●
Process	Business Process Reengineering	●	●	⦿	⦿	●	●	●	●	●	●
	Customisation Approach	⦿	○	○	○	●	⦿	⦿	●	⦿	×
	Performance Measurement and Control	⦿	⦿	⦿	⦿	⦿	⦿	⦿	●	●	●
Technology	IT Infrastructure	●	●	⦿	●	●	●	●	●	●	●
	Package Requirements and Selection	●	●	○	●	●	○	⦿	●	●	⦿
	System Testing	●	●	⦿	●	●	⦿	●	●	●	●
	System Quality	●	⦿	○	●	●	●	●	●	●	●
	Information Quality	●	●	⦿	●	●	●	●	●	●	●
Organisation	Business and IT Legacy Systems	⦿	●	○	○	●	○	⦿	⦿	⦿	○
	Change Management	●	●	⦿	⦿	⦿	●	●	●	●	●
	Effective Communication	⦿	●	⦿	●	●	●	●	●	●	●
	Business Vision Goals and Objectives	●	●	●	●	●	●	●	●	●	⦿
	Training and Education	●	●	⦿	●	⦿	●	●	●	●	●
	Organisational Structure and Culture	⦿	⦿	●	●	●	●	●	●	●	⦿
Project	Project Management	●	●	⦿	●	●	●	●	●	●	●
	Budget – Cost Parameters	●	●	⦿	⦿	⦿	●	●	●	●	●
	Time	⦿	●	⦿	●	⦿	⦿	●	●	●	●

Table 5.4: Validation of Factors Influencing ERP Adoption and Implementation at SSO_I

Table 5.5 is a summarised version of Table 5.4. Average results highlight the final rank for each factor derived based on all the ten responses. The interpretation provided is based on author's own judgment irrespective of average obtained. This interpretation should not be considered as author's bias but is based on valid rationale evident from the literature, secondary data of SSO_I, and observations made in the SSO_I whilst interviewing managers.

	Factors Influencing ERP	High	Medium	Low	N/A	Average of Responses
		Frequency of H, M, L from 10 Responses				
Stakeholders	Top Management Commitment (TMC)	10	–	–	–	H
	Project Champion (PC)	5	3	2	–	M
	Execution Team (ET)	8	2	–	–	H
	Qualified IT Staff (QITS)	8	2	–	–	H
	External Advisory Support (EAS)	4	5	1	–	M
	Vendor Partnership (VP)	8	1	1	–	H
	Total End-User Involvement (TEUI)	8	2	–	–	H
Process	Business Process Reengineering (BPR)	8	2	–	–	H
	Customisation Approach (CA)	2	4	3	1	L
	Performance Measurement and Control (PMC)	3	7	–	–	M
Technology	IT Infrastructure (ITI)	9	1	–	–	H
	Package Requirements and Selection (PRS)	6	2	2	–	H
	System Testing (ST)	8	2	–	–	H
	System Quality (SQ)	8	1	1	–	H
	Information Quality (IQ)	9	1	–	–	H
Organisation	Business and IT Legacy Systems (BITS)	2	4	4	–	L
	Change Management (CM)	7	3	–	–	H
	Effective Communication (EC)	8	2	–	–	H
	Business Vision Goals and Objectives (BVGO)	9	1	–	–	H
	Training and Education (TE)	8	2	–	–	H
	Organisational Structure and Culture (OSC)	7	3	–	–	H
Project	Project Management (PM)	9	1	–	–	H
	Budget – Cost Parameters (BCP)	7	3	–	–	H
	Time (T)	6	4	–	–	M

Table 5.5: Analysis of Factors Influencing ERP Adoption and Implementation at SSO_I

The findings from the primary data and author's interpretation demonstrate that most of the factors influencing the decision making process for ERP adoption and implementation are highly significant. The results presented thus far (as also mentioned earlier) in Table 5.4 and 5.5 are merely based on general discussions during the interview sessions, interviewees understanding on

ERP systems and author's observation during the interview sessions. The author denotes that these results may not seem adequate because these results are based on each interviewee's observation and understanding. The author argues here that simply by conversing on factors and accomplishing the vocal responses during the interview session, it may be unlikely to identify the particular significance of each factor. Due to this rationale and to improve the research, the author focused on prioritising the importance of factors using an AHP technique. This technique along with its utilisation is highlighted in the following section.

5.2.4.2 Assessing Research Proposition 2: Prioritising the Factors Influencing ERP Adoption and Implementation

In the previous section, the author highlighted the importance of factors based on Miles and Huberman's (1994) scale of high (●), medium (⦿) and low (○), however, as argued this may not be enough to justify the importance of factors influencing ERP adoption and implementation in SSOs. The author takes a step forward and employs the AHP technique to precisely prioritise the factors based on their importance sighted by managers in the SSO_I. In so doing, ranks the factors from the most important to the least important. In order to prioritise the factors, however, a sequential and iterative procedure is followed for the responses received from each interviewee. This section of the interview in the primary data collection and analysis applies the following AHP technique steps to calculate the final priority level of each factor using a nine-point scale (Table 4.7).

Literature highlights that AHP enables decision-makers to form an intricate problem in a hierarchical structure demonstrating the core affiliations of the goal, objectives (criteria), sub-objectives, and alternatives including four fundamental stages that are described as follows:

- **Step 1 – *The Hierarchy Model:*** The first step in studying the importance of factors influencing ERP adoption and implementation in SSOs is to develop the ERP adoption and implementation factors' hierarchy model. The author has explained this step in detail in Section 4.5.3.3. The second case i.e. SSO_II also follows that similar ERP adoption and implementation factors' hierarchy model.

- **Step 2 – *Data Collection through Pairwise Comparison:*** The interviewees were explained on how to conduct the pairwise comparison between each factor. The interviewees, however, highlighted that rather than focusing on all the factors together as a long list, it would be much better to group the relevant factors in their respective factor category. The interviewees perceived that this would assist them in better comprehending the significance of ERP adoption and implementation factors. The author also signifies that it can be easy to comprehend the appropriateness of a specific factor subject to defining the respective factor categories.

  The assessment of the importance of factors can be made instinctively and changed to a mathematical value using a pairewise comparison scale. The mathematical values demonstrating the assessment of the comparisons are put in order in a matrix for further computation. The author demonstrates only one matrix as presented in Table 5.6 for the first interviewee Director of Information Technology (D_IT). The remaining nine matrixes for other nine interviewees follow the same pattern and are presented in Appendix D. Table 5.6 presents the initial set of data collected from interviewees. For example, note the reciprocals across the diagonal i.e. (top management commitment/project champion) is 5, while (project champion/top management commitment) is 1/5.

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	5	3	7	5	9	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/5	1	2	3	5	6	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/3	½	1	3	5	7	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/7	1/3	1/3	1	4	5	½	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/5	1/5	1/5	¼	1	3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/9	1/6	1/7	1/5	1/3	1	¼	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/4	¼	1/3	2	3	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	5	7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/7	½	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/7	1/4	1/6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	1/5	1/3	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7	5	1	5	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	3	1/5	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	4	1/2	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	1/4	1/6	1/5	2	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	2	1/5	1/4	4	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	1/2	1	1/4	1/3	4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	5	4	1	2	6	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	4	3	1/2	1	5	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	½	1/4	1/4	1/6	1/5	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	4
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	3
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/3	1

Table 5.6: Individual Normalised Numerical Ranking of Factors by D_IT

- **Step 3 – *Determine Normalised Priority (Local) Weights:*** The third step is to determine the individual normalised priority (local) weights of all the factors. For this purpose, the author used the Expert Choice – an AHP-based multi-objective decision support mathematical software for computing the weights. This software assists during the designing, synthesis and validation of intricate individual and or group decisions in an organisation. Table 5.7 presents the individual normalised ranking of factors (in their specific category) by all interviewees (each column signifies an individual interviewee).

		INTERVIEWEES AND THEIR RESPONSES – LOCAL WEIGHTS									
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**
Stakeholders	Top Management Commitment	0.414	0.258	0.421	0.295	0.377	0.438	0.333	0.338	0.288	0.298
	Project Champion	0.198	0.041	0.024	0.065	0.031	0.227	0.173	0.066	0.247	0.049
	Execution Team	0.163	0.354	0.092	0.19	0.077	0.134	0.095	0.1	0.179	0.125
	Qualified IT Staff	0.075	0.1	0.172	0.157	0.053	0.1	0.154	0.04	0.127	0.095
	External Advisory Support	0.041	0.028	0.158	0.113	0.233	0.03	0.04	0.025	0.035	0.053
	Vendor Partnership	0.023	0.054	0.071	0.113	0.152	0.02	0.115	0.176	0.36	0.151
	Total End-User Involvement	0.086	0.166	0.062	0.068	0.077	0.05	0.089	0.254	0.087	0.23
Process	Business Process Reengineering	0.74	0.793	0.671	0.603	0.707	0.648	0.701	0.637	0.54	0.286
	Customisation Approach	0.167	0.076	0.256	0.082	0.223	0.122	0.106	0.258	0.163	0.143
	Performance Measurement and Control	0.094	0.131	0.073	0.315	0.07	0.23	0.193	0.105	0.297	0.571
Technology	IT Infrastructure	0.037	0.03	0.508	0.1	0.483	0.105	0.136	0.486	0.323	0.099
	Package Requirements and Selection	0.089	0.148	0.071	0.1	0.267	0.057	0.056	0.307	0.26	0.156
	System Testing	0.443	0.301	0.137	0.2	0.051	0.283	0.363	0.052	0.097	0.318
	System Quality	0.131	0.117	0.181	0.2	0.109	0.146	0.253	0.055	0.182	0.184
	Information Quality	0.3	0.405	0.103	0.4	0.091	0.409	0.192	0.1	0.138	0.242
Organisation	Business and IT Legacy Systems	0.05	0.028	0.024	0.059	0.034	0.035	0.086	0.024	0.06	0.087
	Change Management	0.125	0.048	0.06	0.118	0.228	0.438	0.274	0.247	0.321	0.275
	Effective Communication	0.112	0.098	0.047	0.118	0.057	0.129	0.232	0.163	0.137	0.173
	Business Vision Goals and Objectives	0.4	0.459	0.458	0.235	0.468	0.086	0.102	0.19	0.214	0.138
	Training and Education	0.274	0.144	0.146	0.235	0.072	0.266	0.17	0.19	0.189	0.218
	Organisational Structure and Culture	0.038	0.223	0.265	0.235	0.141	0.047	0.135	0.186	0.08	0.109
Project	Project Management	0.614	0.674	0.655	0.6	0.279	0.674	0.493	0.117	0.493	0.655
	Budget – Cost Parameters	0.268	0.226	0.25	0.2	0.649	0.226	0.311	0.268	0.311	0.25
	Time	0.117	0.101	0.095	0.2	0.072	0.101	0.196	0.614	0.196	0.095

Table 5.7: Normalised Numerical Ranking of Factors by all Interviewees

- **Step 4 – *Evaluating and Computing the Priority Weights:*** Based on normalised numerical ranking of factors (i.e. the priority weights) from previous Step 3, the relative priority importance of ERP adoption and implementation factors in a specific category are evaluated and computed in Tables 5.8. These priority weights are obtained by using the EC software and the conclusions drawn from them are the final results of the analysis of collective judgements provided by the panel of interviewees selected for SSO_I. The results are based on the knowledge, judgement and understanding on the factors by all the interviewees at SSO_I.

	Factors Influencing ERP	Global Weight
Stakeholders	Top Management Commitment	0.346 (1)
	Project Champion	0.112 (5)
	Execution Team	0.151 (2)
	Qualified IT Staff	0.107 (6)
	External Advisory Support	0.076 (7)
	Vendor Partnership	0.124 (3)
	Total End-User Involvement	0.117 (4)
Process	Business Process Reengineering	0.633 (1)
	Customisation Approach	0.160 (3)
	Performance Measurement and Control	0.208 (2)
Technology	IT Infrastructure	0.231 (2)
	Package Requirements and Selection	0.151 (5)
	System Testing	0.225 (3)
	System Quality	0.156 (4)
	Information Quality	0.238 (1)
Organisation	Business and IT Legacy Systems	0.049 (6)
	Change Management	0.213 (2)
	Business Vision Goals and Objectives	0.275 (1)
	Effective Communication	0.127 (5)
	Training and Education	0.190 (3)
	Organisational Structure and Culture	0.146 (4)
Project	Project Management	0.525 (1)
	Budget – Cost Parameters	0.296 (2)
	Time	0.179 (3)

Table 5.8: Global Priority Weight of Factor Influencing ERP Adoption and Implementation

The next research proposition 3 is on phases (Section E in Appendix C for details) and stages (Section F in Appendix C for details) of the ERP Adoption and Implementation lifecycle. This research proposition is discussed in light of the case study and tested for its validity in the context of SSO_I.

5.2.4.3 Assessing Research Proposition 3: ERP Lifecycle Phases and Stages

This section presents the empirical findings of ERP lifecycle phases and implementation stages at SSO_I.

5.2.4.3.1 ERP Lifecycle Phases

To ascertain the organisation's view of the ERP lifecycle, the author collected the feedback from the interviewees based on macro and micro views of the lifecycle. Most of the executives at SSO_I agreed that ERP has two distinct features that impact the operations of the businesses: external/macro lifecycle phases and internal/micro functional stages. With regards to ERP implementation process, the head of the ERP implementation team said that:

> "*The functions and activity based processes are mould within different implementation phases and this is what distinguishes ERP system from legacy mainframe based systems.*"

This is also echoed in the literature that ERP possesses three main phases and functional stages (Parr and Shanks 2000). SSO_I divided their ERP adoption process in the three main phases: *pre-implementation*, *implementation* and *post-implementation*. The implementation has not yet finished for all departments as SSO_I initially followed the phased approach as compared to big bang approach, and in addition, SSO_I also had to change two suppliers due to buy-out with one of the suppliers and differences over installation process and services with the other. The three main phases are now explained herein:

Pre-Implementation Phase – I: SSO_I in their pre-implementation phase gave maximum importance to need analysis, resources availability and top management support for resources allocation. The concerned ERP implementation team management further divided this phase into planning, creation of sub-plans and actual execution of functional activities. The main goal of this ERP solution was a part of strategic initiative to update all the infrastructure of the SSO_I and increase the company's competitive edge in terms of technology use as compared to local and foreign airlines. Top management has three prime aims in their master plan to: *(a)* privatise the company; *(b)* restructure and reposition the company in the industry and (c) update infrastructural and IT facilities. To update the technology, structure and business process of the firm, SSO_I decided to adopt ERP. The project went through the six major phases of: *need analysis*, *qualifying the products*, se*lection of consortium and scope of statement of work*, *contracting*, *site preparation* and *Go Live*. The pre-implementation planning activities include preparing the pre-requisites for the complete project. This involved procurement of all required materials, deploying technical and human resources across the organisation, migrate and update all non-SAP based network and systems, establish integration plan, devise roles of supporting functions and phase out the old system. This is the sequence of main plan that contains sub-plans in each of six phases (Figure 5.1).

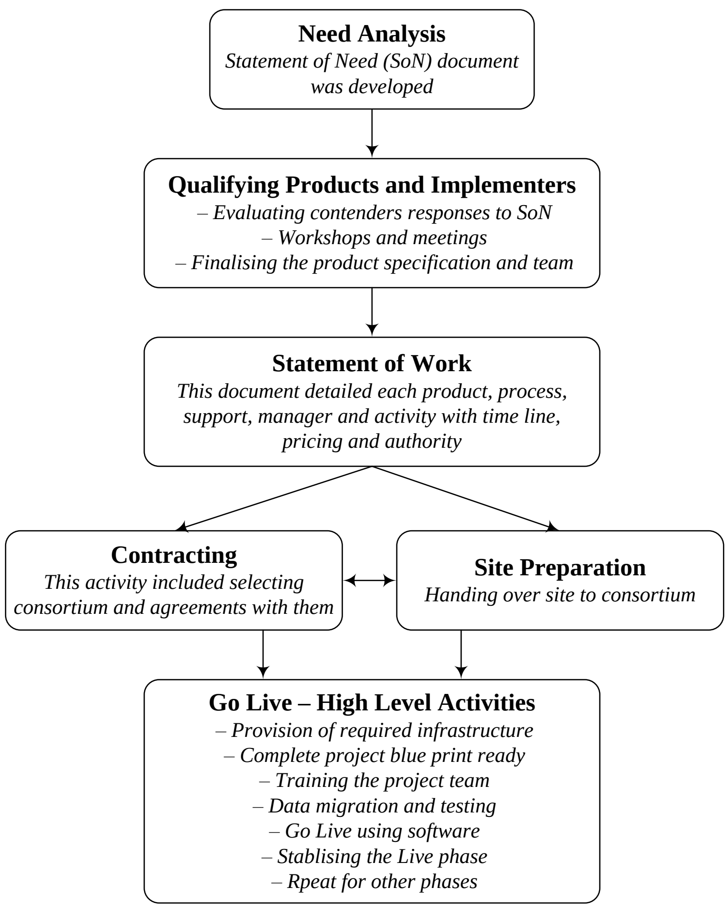

Figure 5.1: Main ERP Implementation Plan for SSO_I

SSO_I had four major tasks that were grouped into: *requirements collection*, *planning and preparation*, *system selection* and *implementation*. SSO_I is considered as one of the biggest companies in KSA and a backbone of Saudi industry and economy. Thus, to minimise the risk of losses and chaos, SSO_I adopted a phased approach for implementation and selecting functional departments. These departments would be part of the Go Live phase instead of the "Big Bang" organisation wide approach of IT restructuring and ERP implementation (Al-Mashari *et al.*, 2006; Ross and Vitale, 2000 and Woo, 2007). It has already taken five years for the SSO_I and it has yet to complete the logistics and MRO modules to be covered in the ERP implementation. However, the rest of the four modules: FICO-I, FICO-II and HCM are installed, live and are running successfully at SSO_I. The implementation of Logistics and MRO may take another 12 to 24 months before project reaches the completion. Initial time line of 3 years has been extended for another 2 years. Earlier few phases of implementation were agreed but with time it evolved into bigger project and more phases were added.

In this pre-implementation phase, one of the most important factors which can affect the ground work and further successful implementation is the support and commitment from top management. Since, top management approves all allocations of resources and capital budget outlays their support becomes crucial in any such project. SSO_I, director general and executive vice president from top management have taken responsibility for ERP implementation. Thus, top managers were very much supportive to allocate the required resources from day one as they have realised the importance of ERP within the company and competition in the globalised business world (Dawson and Owens, 2008; Arnold, 2006; Ngai *et al.*, 2008). In this case, top management realised the need of external expertise and as mentioned in the main plan a thorough need analysis was carried out by SSO_I with the help from external consultant KPMG. Also, executive/steering committee drafted the ERP implementation strategy which was part of business and corporate level strategies for organisational development and corporate strategy for restructuring (Hong and Kim 2002; Nah and Delgado, 2006; Doom *et al.*, 2010; Upadhyay *et al.*, 2011).

Manager gave higher importance to the selected ERP implementation process chosen and this is reflected in the ERP design and implementation during later lifecycle phases and implementation stages. Table 5.9 provides an overall analysis of the categories for the ERP adoption and implementation which is closely coupled with preparation of objectives and motivation to make of use of the ERP by all employees at SSO_I. The table highlights the managerial feedback in the form of priority given by SSO_I managers to the perspectives in the process of adopting the ERP implementation**.** Ten managers provided priority to five categories assigning each of them a priority between 1 (1 being the most important) and 5 (5 being the least important). Priority averages are considered along with author's interpretation of how much priority scores are obtained from all available responses.

	INTERVIEWEES AND THEIR RESPONSES										Average of 10
Factor Categories	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	
Stakeholders	4	1	2	4	3	1	1	1	3	1	2.1 (1)
Process	1	4	3	2	1	4	1	3	1	2	2.2 (2)
Technology	3	5	4	5	2	4	3	5	4	5	4.0 (5)
Organisation	5	2	5	3	3	2	2	2	2	4	3.0 (3)
Project Management	2	3	1	4	5	5	5	4	5	3	3.7 (4)

Table 5.9: ERP Adoption and Implementation Categories at SSO_I

It is clear from Table 5.9 that the highest importance is given to stakeholders and business process objectives as compared to ERP as a project and a new technology. Stakeholders and business process are the categories which mainly comprise the targeted benefits. The major benefits from the ERP for SSO_I are streamlining the overall business process and increase the monitoring over activities which involve the wider groups of stakeholders and their satisfaction. Organisation, project and technology are the categories which can be temporary with time as today's business dynamics and technology advancements are uncertain and rapid changing. On the other hand, project management can be of finite duration as well up to the completion of one first full lifecycle of ERP (Somers and Nelson 2004; Dong *et al.*, 2009; Muscatello and Chen, 2008; Dezdar and Sulaiman, 2009). In addition to the motivation derived from targeted benefits for these implementation perspectives, the appropriate way of selecting the ERP is to look for value addition in the business process, operational efficiency, customer satisfaction and corporate image so that company can achieve competitive advantage. This is true in the case of SSO_I as it can acquire more profit returns and market share if their service delivery can be significantly improved due to ERP. The ERP was essential for SSO_I due to inadequacy of the old system and the necessity of competitive edge in the airline industry to retain the competitive advantage (O'Brien and Marakas, 2007). Considering the distinct importance each perspective has, it is suggested that all perspectives are important to be analysed before adopting ERP. This is because ERP has to support all functions and business strategies of the organisation (Albert *et al.*, 2005; Verville *et al.*, 2005; Wu and Wang, 2006).

SSO_I Modules

SSO_I modules are tightly integrated, online and in real time to provide an instantaneous snapshot of the business. Each module and its technological platform are pre-set with objectives, inputs and deliverables. The major modules for SSO_I included:

- **Financial Accounting and Control**

  The Finance (FI) and Controlling (CO) modules provide a fully integrated solution for an organisation's financial management requirements including both statutory and management reporting. The financial and controlling modules provide full accounting support for the organisation's main business processes which reside in the maintenance area. Finance and controlling module allow to:

  - Integrated assets control across functional areas such as financial balances in Assets
  - Accounting, logistics and quantities handling in Materials Management as well as maintenance life cycle tracking in Plant Maintenance (MRO / Engineering).
  - Subcontracting of maintenance and support work performed on own assets/parts by third parties.
  - Unique supplier agreements such as special/emergency stock holdings or consignment agreements.

- **Human Resources**

  Human Resource module supports the requirements of a modern Human Resource Management, by providing a central up-to-date repository of all employees' data. Moreover, it has the ability to manage an employee's relationship with the company from recruitment through development and ultimately to leaving or retirement stage. Human Resource module provides the most comprehensive, integrated technology and service solutions in the market.

Industry analysts agree that in terms of completeness of vision and ability to execute, the HR offering is the industry leader. It is considered as the only HR solution that integrates external knowledge with the way an organisation runs its business.

HR module components that are likely to be relevant to SSO_I are such as:

- Personnel Administration.
- Organisational Management.
- Payroll.
- Recruitment.
- Personnel Cost Planning.
- Personnel Development.
- Compensation Management.
- Training and Event Management.
- Occupational Health.

- **Logistics**

Logistics Execution offers an extremely flexible and powerful suite of functionality that whilst retaining its core underpinning capability, has benefited from some new and exciting enhancements. The streamlined procurement cycle, including its catalogue-based self-service, enables customers to closely monitor and control their spending. Timely information exchange with vendors is facilitated and improved using Supplier Collaboration. Inventory can be closely controlled, tracked and quality-assured, and therefore optimised using SAP's versatile Inventory Management and Warehouse Management components. This further allows the customers to see online, real time global inventory balances and up-to-the-minute stock movements. Inbound and Outbound Logistics, together with Transportation Management offers a complete shipping and receiving process, allowing shipments to be created, consolidated, and tracked. The combined reporting functionality of SAP's Procurement and Logistics Execution provides customers with the ability to make more informed business decisions, which leads to improved customer satisfaction and reduced costs.

Implementation Phase – II: As discussed earlier, managers of the SSO_I had no prior experience in dealing with high level technology such as ERP. Hence, the consortium of suppliers was selected to support with end-to-end planning, design, training, installation and post-live support. The help was sought from the need analysis and suppliers’ short listing itself with the help of KPMG. Also, the SSO_I built a centre of excellence that to-date manages most of the customised development and specific needs of the business. This centre created a support system for main contractor in implementing the ERP. The relationship with all consortium suppliers went well for three years but difficulties in the last phase of implementing ERP MRO module resulted into the termination of contract with main supplier and new supplier IBM was awarded the rest of the work. Main objective of this phase is to fit ERP within organisational structure frame and align the organisation culture, functional activities and strategies with the ERP. The departments that were included in the ERP implementation phase are: human resources, finance, information technology, logistics and maintenance.

In the context of data migration is a key step towards achieving overall system functionality. Data migration for SSO_I is performed by Vendor_4 in the support of the SAP implementation. In doing so, a number of specialised activities were conducted in order to convert the related data (i.e. the master, transactional and historical) from the current legacy applications and migrate the relevant data to designated modules of the new ERP+MRO application. The whole data migration process in this project follows three distinct activities, such as: *(a)* transforming the data extracted from legacy applications in the format of SAP system, *(b)* cleansing and refining the data extracted from the legacy applications, and finally *(c)* the creation of tasks list to performed by Vendor_4. The latter is achieved in order to fulfil the objectives of migrating SSO_I’s legacy data to new system solution whilst certifying that the data in the new system will be valid and of quality.

Post-implementation – III: The post-implementation outcome and strategy to deal with ERP issues depend on the various direct factors such as the results of implementation, its benefits achievement, priorities served by ERP and further indirect impacts on the organisational design, culture and company’s business performance (Zhang *et al.,* 2002). The measures of ERP implementation outcome is difficult in the SSO_I because the implementation of two major modules i.e. logistics and plant maintenance are in the process of implementation by the supplier IBM. In addition to this, there are no measurement plans implemented at corporate level but plans exist down the hierarchy in the sub-levels in the departments, wherein ERP has been already implemented. There are plans to define all the services supplied in the form of ERP so that company can measure the outcome on the organisational performance.

The impacts of measuring ERP implementation and its benefits can be positive in terms of assessing where the organisation stands or doing gap analysis. This can help in defining the corrective actions for improving any issues which are un-resolved in the design (pre-implementation) or go-live (implementation) phase. The negative impacts can be in terms of costs, if more training is required for operational staff; redesigning or making changes in the implemented modules. These impacts and benefits are not only in the departments where ERP applications are used but they are across the organisation. Since, ERP implementation is an evolving process, the learning from the ERP solution experience may affect the future management decisions too (Law *et al.,* 2010). The SSO_I's areas of improvement in the business process are prioritised in Table 5.10. All respondents rated the six targets areas based on the six priority scale with 1 being very important and 6 being less important. This does not mean an attribute prioritised as number six is not important. Instead, it carries less priority over other factors for the SSO_I's sustainable growth and competitiveness.

	INTERVIEWEES AND THEIR RESPONSES										
Improvement target from ERP implementation	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Average of 10**
Operational Efficiency	1	1	3	1	2	2	1	3	5	1	2.0 (1)
Market Share	6	4	1	5	5	5	3	6	6	2	4.3 (4)
Financial	2	2	4	3	1	4	2	2	3	4	2.7 (2)
Competitive Edge	3	3	2	2	4	1	4	5	2	3	2.9 (3)
Human Capital	5	5	5	4	6	6	5	1	4	5	4.6 (6)
Technical Advantage	4	6	6	6	3	3	6	4	1	6	4.5 (5)

Table 5.10: SSO_I Priority of ERP Benefits

As for the theoretical concerns, impacts on the organisational performance and factors affecting ERP implementation are two different perspectives. Factors affecting are input variables which influence the phases and stages of ERP implementation process. Whereas the impacts on the organisational performance are the output of the ERP implementation, which can either affect positively or negatively the organisation and its overall performance. This has been discussed with the SSO_I managers and their view of 'no need to separate between the ERP impacts and other factors influence on the organisational performance' differs from the theoretical perspective quite arguably. Although, according to managers' suggestions there is no difference between impacts and factors, there is still mechanism in place to measure the feedback from end users to find the impacts of ERP (as mentioned in the official document statement of work). However, mangers say there is no procedure for collecting feedback from end users which is one of the major negligence of the project. The first hand alternative to study feedback is to monitor and review the change request or trouble shooting tickets created by end users during and post Go Live phases in the implementation. The other ways of obtaining the feedback includes blue print workshops, user acceptance testing and system end use testing. After assessing the major three phases of ERP implementation in the SSO_I, the next section assesses the stages in the ERP implementation.

5.2.4.3.2 ERP Implementation Stages

In order to successfully implement ERP, there are some key activities that play a crucial role such as preparing statements of needs and works collection, governance, change management, blueprints design and acceptance by business, data migration, testing system and user acceptance, top management support and training to employees. Among these activities, the stage of blue print design can be considered as the most important as it highlights whether ERP contains all business processes. In so doing, it is regarded as the decider for the rest of the project activities and schedules. The importance of each activity in the whole process, however, can be defined as follows (these stages are part of the theoretical proposition).

- ***Initiation:*** Clear statement of work and objectives, requirement collection,
- ***Adoption:*** Contracting and service level agreements, verifying the scope,
- ***Implementation:*** Project blueprint and controlling, and monitoring,
- ***Shakedown:*** Post go-live support and stabilisation period,
- ***Evolution:*** Including other strategic business units such as medical services, and
- ***Optimisation:*** Reviewing the processes, realising benefits and optimising them.

The challenges during this vital stage are the uncertain market dynamics and organisational responses to the rapid market changes. Hence, the most difficult activity is to anticipate and to accommodate such changes in the ERP such as scheduling and change management. The other intricacies involved in this activity are that end users are not fully trained for each ERP component. Hence, they do not have enough knowledge of ERP and end users cannot manage the interaction schedule in time with suppliers. To avoid such pitfalls and to thwart the threats as part of the ERP implementation strategy, risk assessment, migration, and planning procedures were put in place within the project blue print. Issues and risks are logged into the system separately. Issues are considered arising as a primary problem which if not solved then gets converted into risk with a severity scale label. Around the world, non-realisation of any tangible outcomes of ERP implementation is common arising out of any risk not dealt with. The SSO_I anticipated that re-planning of the implementation process might be necessary to invoke the pre-designed implementation process. Before proceeding further for re-planning, the SSO_I managers always analyse problems and causes to support their decision making processes.

This decision making in the SSO_I involves team dynamics and key stakeholders, top executives, end users, IT staff and consortium of suppliers of the ERP in the implementation process. There was pre-set blue print for the project and statement of work as agreement between company and suppliers. On the other end to control the implementation from a central source, SAP solution manager was the main module. SSO_I adopted functional tools namely ASAP methodology, advanced help desk (AHD), inter project manager (IPM), all are provided by the SAP supplier. The control system is not 100% utilised as two modules are left to be installed and profit protection points are not yet defined. SSO_I is a service industry competitor without tangible products manufactured which makes it difficult to analyse or to measure service quality and productivity per employee in terms of costs and revenue.

Change and Conflict Management: Change management is considered as main activity involving all the stages of the implementation. Due to this the most important aspect for top management and other stakeholders is to accept the new technology and to adapt to the situation thereby repositioning the business process as a whole. No conflicts were noted within project teams of SSO_I. But, due to major differences with main contractor during the ERP implementation process, IBM was awarded the task of implementing the last two modules of logistics and maintenance. Lack of commitment, lack of decision making and shortage of resources such as latest infrastructure or skilled staff were the main barriers in the implementation process. Major causes for the conflicts can be attributed to change management process, implementation procedure or business process functionalities in the ERP wherein the group of employees did not agree on the specific actions/functions in the ERP implementation.

ERP adoption stages: The author has proposed six stages as major components of the lifecycle process of adopting and implementing ERP in the initial theoretical proposition. Any organisation that aspires to adopt ERP passes through these stages. The importance of dividing the stages is in terms of allocating resources, better planning and post Go Live state an easier change management. Managers in the SSO_I were asked to rate the importance of each stage in the overall ERP lifecycle.

Table 5.11 highlights the responses received from the interviewees in relation to the six ERP lifecycle adoption and implementation stages. It is clear from the Table 5.12 that almost all the stages were considered vital with exception to eleven response with medium importance and two with lower importance. This findings also indicates that the interviewees do realise the significance of following these stages whilst adoption and implementation a technological solution.

	INTERVIEWEES AND THEIR RESPONSES									
Lifecycle Stages	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**
Initiation	⦿	●	●	●	●	●	○	⦿	●	●
Adoption	●	●	●	●	●	●	●	●	●	●
Implementation	●	●	●	●	●	●	●	●	●	●
Shakedown	●	●	●	●	●	●	⦿	⦿	●	●
Evolution	●	⦿	●	●	●	●	●	○	●	●
Optimisation	⦿	⦿	●	●	●	⦿	⦿	⦿	●	⦿

Table 5.11: Validation of ERP Lifecycle Adoption and Implementation at SSO_I

Table 5.12 highlights the findings and interpretation of the author from findings based on the scale of high (H), medium (M) and low (L), as proposed by Miles and Huberman (1994). The common feedback from managers illustrates that all stages are important for the successful outcome of deploying ERP in the organisation. However, the most important stages were identified to be within the *pre-implementation* and during the *implementation* as compared to the *post-implementation*. This is similar to the view of previous research findings in the literature (Markus and Tanis 2000; Al-Mashari *et al.*, 2006; Chang *et al.*, 2008).

Lifecycle Stages	High	Medium	Low	N/A	Final Interpretation
	Frequency of H, M, L from 10 Responses				
Initiation	7	2	1	=	High
Adoption	10	=	=	=	High
Implementation	10	=	=	=	High
Shakedown	8	2	=	=	High
Evolution	8	1	1	=	High
Optimisation	3	7	=	=	Medium

Table 5.12: Analysis of ERP Lifecycle Adoption and Implementation at SSO_I

The head of IT department asserted that:

> *"The initialisation and blueprint stages were very important because this was where any organisational resistance from top management or employees was resolved and need analysis and user requirements were finalised. Any erroneous action can get magnified from this point to later stages".*

SSO_I has not exactly followed the similar process of ERP implementation but they categorised various activities implementing ERP into six stages:

- ***Initialisation:*** A preparation stage,
- ***Blueprint:*** Defining users requirement,
- ***Realisation:*** Design of the ERP,
- ***Testing:*** Final checks and acceptance in the network,
- ***Go Live:*** Actual operations using the ERP start, and
- ***Support:*** Monitoring and troubleshooting the use of ERP.

The initial two stages involved strong emphasis from external stakeholders (i.e. advising firm, individual consultants and a consortium of suppliers). These external stakeholders filled the knowledge gap and pertinent skills related to ERP that lacked in the employees of SSO_I. This was advantageous in terms of skills transfer, motivation increase and human capital build up but the down side was organisational and cultural differences. Each of the stage mentioned above involved compulsory activities such as discussion and research by company executives and suppliers jointly. This discussion and research was like carrying out a pilot study including feasibility and appraisal for capital outlay. These pre-initialisation activities generated an idea of what type of resources is required and how much (Al-Mashari *et al.*, 2006; Dong *et al.*, 2009). The motivation has been infused to employees through training and learning new skills which have made them realised that they had more capabilities such as operating and managing ERP. According to senior HR manager:

> *"The resistance to adopt new system reduced gradually once employees and top management realised the benefits and opportunities of implementing ERP in their departments and organisation wide"*.

The formation and finalisation of a project team took place in the blueprint stage. This project team comprised of departmental heads and key personnel from top management who would have then complete responsibility of being an interface between end users and vendors. This supports the initial stages being highly important as echoed earlier in the theoretical proposition and previous studies about ERP (Dawson and Owens, 2008). Before adopting and implementing the ERP system, organisations should analyse their business processes and map it to the new proposed ERP system for implementation. This may include organisational review, gap analysis and a broad feasibility study. The findings of such a review are helpful in the decision making by top management.

5.2.4.4 Assessing Research Proposition 4: Mapping the Factors Influencing ERP Adoption and Implementation on Lifecycle Stages

This section presents the empirical findings on the mapping of factors influencing ERP adoption and implementation process at SSO_I. In Section F (Appendix C) of the interview, the participants (i.e. the managers) were asked to perform the mapping of each factor on the ERP lifecycle stages. This section only highlights the mapping of factors by all ten interviewees for the 'Initiation' stage as presented in Table 5.13 (for the purpose of explaining the whole process of mapping), the remaining tables for mapping of factors on adoption, implementation, shakedown, evaluation and optimisation stages are presented in Appendix E (these tables also follow the same practice of mapping of factors on ERP lifecycle stages, however, the results are different). Before starting on the process of mapping the factors on the stages, the author explained the interviewees the overall process of conducting the mapping of factors. Subsequently, the interviewees were individually asked to map the factors influencing ERP adoption and implementation on different stages of the ERP lifecycle. The interviewees went through an arduous brainstorming session and mapped the factors (based on its significance) on each stage of the lifecycle. For example, Table 5.13 highlights the mapping of factors for all ten interviewees with the last column demonstrating the outcome of the mapping of factors by the interviewees. A specific factor was considered to be important if 5 or more interviewees selected it in a particular stage and re-tabulated in the final column of each stage. Interviewees then mapped the factors based on their understanding of ERP. The results presented in Table 5.13 are for the initiation stage where from the total of 24, only 12 factors were selected to be significant by most of the interviewees. The results highlight varied findings from the mapping of factors on this stage. The outcome of mapping can be attributed to the understanding and reflection of each interviewee during their respective ERP projects.

		INTERVIEWEES AND THEIR MAPPING THE INITIATION STAGE										
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Project Champion	–	✓	✓	✓	–	–	–	✓	✓	✓	6/10
	Execution Team	–	✓	–	✓	–	–	–	–	✓	–	3/10
	Qualified IT Staff	–	✓	–	✓	✓	–	–	–	✓	✓	5/10
	External Advisory Support	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	9/10
	Vendor Partnership	–	✓	–	✓	–	✓	–	✓	–	–	4/10
	Total End-User Involvement	–	✓	–	✓	–	–	–	–	✓	–	3/10
Process	Business Process Reengineering	–	✓	–	–	–	✓	–	–	✓	–	3/10
	Customisation Approach	–	✓	–	–	–	✓	–	–	✓	–	3/10
	Performance Measurement and Control	–	–	✓	–	–	–	–	–	–	–	1/10
Technology	IT Infrastructure	✓	✓	✓	✓	✓	✓	✓	–	✓	–	8/10
	Package Requirements and Selection	✓	✓	✓	✓	✓	✓	–	–	–	✓	7/10
	System Testing	–	–	–	✓	–	–	–	–	✓	–	2/10
	System Quality	–	–	–	✓	–	–	–	✓	–	–	2/10
	Information Quality	–	–	–	–	–	✓	–	–	–	–	1/10
Organisation	Business and IT Legacy Systems	–	✓	–	–	–	✓	–	✓	✓	–	4/10
	Change Management	–	✓	–	–	–	✓	–	✓	✓	–	4/10
	Effective Communication	–	✓	✓	✓	–	✓	–	✓	✓	✓	7/10
	Business Vision Goals and Objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10

	Training and Education	–	✓	–	–	–	–	–	–	–	✓	2/10
	Organisational Structure and Culture	–	✓	✓	✓	–	✓	–	✓	–	✓	6/10
Project	Project Management	✓	✓	–	✓	–	✓	–	–	✓	✓	6/10
	Budget – Cost Parameters	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	9/10
	Time	–	✓	–	✓	–	–	✓	–	✓	–	4/10

Table 5.13: Mapping the Factors on the Initiation Stage at SSO_I

On the other hand, Table 5.14 presents the end results of mapping of factors for all the stages. Factors as highlighted in grey (i.e. with 5 or more responses) are those that are finally selected and considered as the most vital factors, the remaining factors are discarded (i.e. with 4 or less responses). In the latter case, the factors were considered with limited influence or did not influence the decision-making process on a specific stage. For example in the initiation stage, top management commitment received a response rate of 10/10 i.e. all interviewees considered it as a vital factor, whereas, in the optimisation stage, this factor received 4/10 responses. Thus, it was not selected in the optimisation stage.

		ERP Lifecycle Stages					
	Factors Influencing ERP	**Initiation**	**Adoption**	**Implementation**	**Shakedown**	**Evaluation**	**Optimisation**
Stakeholders	Top Management Commitment	10/10	7/10	9/10	6/10	6/10	4/10
	Project Champion	6/10	6/10	8/10	6/10	9/10	6/10
	Execution Team	3/10	5/10	10/10	9/10	7/10	8/10
	Qualified IT Staff	5/10	7/10	10/10	9/10	8/10	9/10
	External Advisory Support	9/10	3/10	10/10	2/10	4/10	2/10
	Vendor Partnership	4/10	6/10	9/10	6/10	6/10	6/10
	Total End-User Involvement	3/10	3/10	8/10	8/10	7/10	6/10
Process	Business Process Reengineering	3/10	7/10	10/10	2/10	4/10	7/10
	Customisation Approach	3/10	1/10	10/10	0/10	3/10	3/10
	Performance Measurement and Control	1/10	1/10	9/10	6/10	9/10	6/10
Technology	IT Infrastructure	8/10	7/10	8/10	4/10	4/10	3/10
	Package Requirements and Selection	7/10	7/10	2/10	0/10	0/10	0/10
	System Testing	2/10	0/10	8/10	5/10	4/10	3/10
	System Quality	2/10	4/10	9/10	6/10	6/10	6/10
	Information Quality	1/10	1/10	7/10	4/10	5/10	7/10

Organisation	Business and IT Legacy Systems	4/10	6/10	8/10	2/10	2/10	1/10
	Change Management	4/10	6/10	9/10	6/10	6/10	5/10
	Effective Communication	7/10	8/10	10/10	8/10	7/10	5/10
	Business Vision Goals and Objectives	10/10	7/10	3/10	0/10	2/10	3/10
	Training and Education	2/10	5/10	8/10	7/10	4/10	7/10
	Organisational Structure and Culture	6/10	7/10	6/10	4/10	4/10	2/10
Project	Project Management	6/10	8/10	10/10	8/10	6/10	6/10
	Budget – Cost Parameters	9/10	8/10	5/10	0/10	1/10	3/10
	Time	4/10	6/10	9/10	8/10	4/10	1/10

Table 5.14: Final Results of Mapping the Factors from all Stage of ERP Lifecycle at SSO_I

In line with the discussion carried out for Table 5.14, the author summarises all those factors that received 5 or more responses in Tables 5.15 to 5.20 along with their priority weights.

Factors Categories	Summary of Factors Influencing ERP in 'Initiation' Stage	Priority Weights
Stakeholders	Top Management Commitment	0.346 (1)
	Project Champion	0.112 (2)
	Qualified IT Staff	0.107 (3)
	External Advisory Support	0.076 (4)
Technology	IT Infrastructure	0.231 (1)
	Package Requirements and Selection	0.151 (2)
Organisation	Business Vision Goals and Objectives	0.245 (1)
	Organisational Structure and Culture	0.146 (2)
	Effective Communication	0.127 (3)
Project	Project Management	0.525 (1)
	Budget – Cost Parameters	0.296 (2)

Table 5.15: Initiation Stage – Summary of Factors with Priority Weights at SSO_I

Factors Categories	Summary of Factors Influencing ERP in 'Adoption' Stage	Priority Weights
Stakeholders	Top Management Commitment	0.346 (1)
	Execution Team	0.151 (2)
	Vendor Partnership	0.124 (3)
	Project Champion	0.112 (4)
	Qualified IT Staff	0.107 (5)
Process	Business Process Reengineering	0.633 (1)
Technology	IT Infrastructure	0.231 (1)
	Package Requirements and Selection	0.151 (2)
Organisation	Business Vision Goals and Objectives	0.275 (1)
	Change Management	0.213 (2)
	Training and Education	0.190 (3)
	Organisational Structure and Culture	0.146 (4)
	Effective Communication	0.127 (5)
	Business and IT legacy systems	0.049 (6)
Project	Project Management	0.525 (1)
	Budget – Cost Parameters	0.296 (2)
	Time	0.197 (3)

Table 5.16: Adoption Stage – Summary of Factors with Priority Weights at SSO_I

Factors Categories	Summary of Factors Influencing ERP in 'Implementation' Stage	Priority Weights
Stakeholders	Top Management Commitment	0.346 (1)
	Execution Team	0.151 (2)
	Vendor Partnership	0.124 (3)
	Total End-User Involvement	0.117 (4)
	Project Champion	0.112 (5)
	Qualified IT Staff	0.107 (6)
	External Advisory Support	0.076 (7)
Process	Business Process Reengineering	0.633 (1)
	Performance Measurement and Control	0.208 (2)
	Customisation Approach	0.160 (3)
Technology	Information Quality	0.238 (1)
	IT Infrastructure	0.231 (2)
	System Testing	0.225 (3)
	System Quality	0.156 (4)
Organisation	Change Management	0.213 (1)
	Training and Education	0.190 (2)
	Organisational Structure and Culture	0.146 (3)
	Effective Communication	0.127 (4)

	Business and IT Legacy Systems	0.049 (5)
Project	Project Management	0.525 (1)
	Budget – Cost Parameters	0.296 (2)
	Time	0.179 (3)

Table 5.17: Implementation Stage – Summary of Factors with Priority Weights at SSO_I

Factors Categories	Summary of Factors Influencing ERP in 'Shakedown' Stage	Priority Weights
Stakeholders	Top Management Commitment	0.346 (1)
	Execution Team	0.151 (2)
	Vendor Partnership	0.124 (3)
	Total End-User Involvement	0.117 (4)
	Project Champion	0.112 (5)
	Qualified IT Staff	0.107 (6)
Process	Performance Measurement and Control	0.208 (1)
Technology	System Testing	0.225 (2)
	System Quality	0.156 (3)
Organisation	Change Management	0.213 (1)
	Training and Education	0.190 (2)
	Organisational Structure and Culture	0.146 (3)
Project	Project Management	0.525 (1)
	Time	0.179 (2)

Table 5.18: Shakedown Stage – Summary of Factors with Priority Weights at SSO_I

Factors Categories	Summary of Factors Influencing ERP in 'Evolution' Stage	Priority Weights
Stakeholders	Top Management Commitment	0.346 (1)
	Execution Team	0.151 (2)
	Vendor Partnership	0.124 (3)
	Total End-User Involvement	0.117 (4)
	Project Champion	0.112 (5)
	Qualified IT Staff	0.107 (6)
Process	Performance Measurement and Control	0.208 (1)
Technology	Information Quality	0.238(2)
	System Quality	0.156 (3)
Organisation	Change Management	0.213 (1)
	Effective Communication	0.127 (2)
Project	Project Management	0.525 (1)

Table 5.19: Evolution Stage – Summary of Factors with Priority Weights at SSO_I

Factors Categories	Summary of Factors Influencing ERP in 'Optimisation' Stage	Priority Weights (Global)
Stakeholders	Execution Team	0.151 (1)
	Vendor Partnership	0.124 (2)
	Total End-User Involvement	0.117 (3)
	Project Champion	0.112 (4)
	Qualified IT Staff	0.107 (5)
Process	Business Process Reengineering	0.633 (1)
	Performance Measurement and Control	0.160 (2)
Technology	Information quality	0.238 (1)
	System Quality	0.156 (2)
Organisation	Change Management	0.213 (1)
	Effective Communication	0.127 (2)
	Training and Education	0.190 (3)
Project	Project Management	0.525 (1)

Table 5.20: Optimisation Stage – Summary of Factors with Priority Weights at SSO_I

The dual comparison of mapping and prioritisation (as presented in Tables 5.15 to 5.20) generates an interesting debate about few of the factors and makes it easier to distinguish between less critical and most critical success factors influencing ERP adoption and implementation. Tables 5.15 to 5.20 explain the priority weights (global) based prioritisation of factors influencing ERP adoption and implementation. They are calculated as an average of the aggregate values derived for all interviewees. The prioritisation levels shown in Tables 5.15 to 5.20 are valid with an underlying assumption that all factors are active. The mapping column shows that a particular factor is considered as influential in the stages it is mapped or found active for this SSO_I by the interviewees.

5.3 Case Study Tow (SSO_II)

Same as in the previous case study, due to confidentiality reasons, the author also agreed to maintain the privacy of participants who acted as the interviewees and the organisation (in this case study). Henceforth, this case study that operates within the telecommunication and IT industry in the Kingdom of Saudi Arabia is one of the highly reputed organisations in the Middle East region, being one of the top ten companies launched by the government of KSA. This case study is termed as SSO_II.

5.3.1 Background to SSO_II

SSO_II is the largest telecommunication services provider in the Middle East and North Africa region and has presence in 10 other countries with headquarter in KSA. According its mission statement, SSO_II strives to exceed customer expectations in a world of constant change so that customers and company together can achieve business success and reach new horizons. Prior to 1998, SSO_II was wholly owned by government of Saudi Arabia. In 1998, KSA government privatised 30% of the original company stock and listed it on Tadawul – KSA stock exchange in Riyadh. Before SSO_II's incorporation in 1998, government of KSA started the activities to restructure the ownership holding, business divisions and IT systems of the organisation – indicating the evolution of ERP systems at SSO_II. Increasing competition worldwide, advancements in the telecommunication technologies and new licenses granted by government influenced the management at SSO_II to adopt ERP solutions. Several other factors such as operational efficiency, business process restructuring, and new business services development strongly emphasized the need of new technological system that can provide a single integrated platform. Their head of IT stated in his interview that:

> *"ERP (BSS - business support system as they call in case company) was very vital to the company business expansion in the country and outside to stay competitive and to retain the market share".*

Accordingly, SSO_II finally adopted a challenging program aiming to transform its business from government system to the recognised commercial business standards. SSO_II has developed clear strategies focusing on internal re-organisation, re-skilling and development of its staff, enhancement of its internal processes and studying its customers' needs and requirements while continuing carrying out its national and social duties and responsibilities (Annual Report, 2009). Keeping in sight the importance of its customers, the SSO_II re-defined its strategic focus in terms of "FORWARD" strategy that aims to re-enforce its competitive positioning in the industry. Cascading of this strategy into the organisational culture with support from ERP for data, information, business intelligence and decision making, the SSO_II will be able to enhance the customer oriented business approach in the organisational design throughout its corporate centre, functional units and business units.

SSO_II divided its business units into four categories: personal, home, enterprise and wholesale clients. They have received many accolades and awards for their accomplishments in the past years. Few of them are: quality award in 2008 by SASO, transparency award for Saudi stock companies from BMG financial consultations firm. SSO_II achieved the following mile stones in the last decade in terms of capital markets and merger and acquisition activities through visionary leadership. These successes were possible because of the core organisational culture which is driven by attributes such as honesty, commitment, co-operation, respect, initiative and loyalty.

- ***1998*** – Incorporation of the SSO_II,
- ***2002*** – Company's IPO is listed,
- ***2003*** – Introduction of DSL services,
- ***2005*** – 10 million mobile customer mark and launch of 3G mobile technology,
- ***2006*** – Raised its capital from 15B to 20B SAR through offering one free stock for every three stocks owned.
- ***2007*** – Acquisition of stake in Maxis communication and its operations in Indonesia and India and wining the third mobile license in Kuwait,
- ***2008*** – Acquired stake in Oger Tel, and
- ***2009*** – Won the third mobile license in Bahrain.

5.3.2 ERP Project Process of SSO_II

SSO_II that has approximately 6 billion SAR of capital in employees cost, requires a sound corporate strategy to integrate business process and employees together to produce customer oriented products and services. In 2009, SSO_II devised the "FORWARD" strategy – a customer centricity strategy that is required to be complemented with adopted ERP solutions. This strategy has seven main components, such as:

- ***F**ulfil* Personal Communication Potential,
- ***O**ffer* Wholesale Services,
- ***R**e-invent* Home Communication,
- ***W**in* Enterprise Customers,
- ***A**chieve* External Growth,

- ***R**e-align* for Customer Excellence, and
- ***D**erive* Operational Efficiencies

This strategy enhanced and developed customers' experiences whilst helping SSO_II to secure international licenses and increase its operational competence.

The previous case study i.e. SSO_I required IT integration for automating their business processes along with customers' online interaction to the organisation. In SSO_II, the organisation provides an array of high end technical services and solutions to retail and other customers in the supply chain. Their customers are segmented into four categories: individual, families, businesses and re-sellers. SSO_II considered ERP as one of the business support system and followed the ten steps of the project management process (Figure 5.2) to adopt the ERP in the organisation.

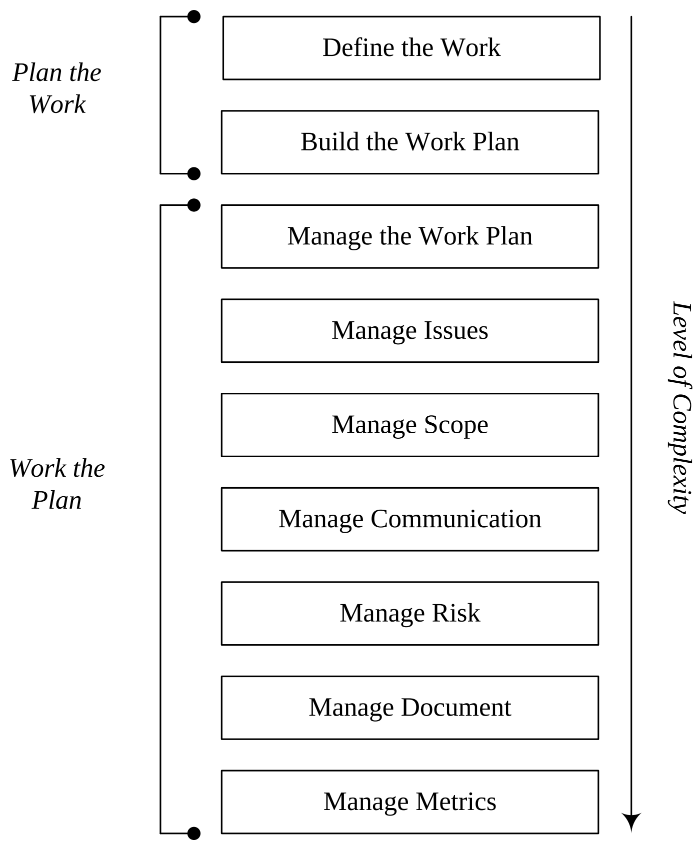

Figure 5.2: Steps for Project Management Process at SSO_II *(Source: Finance and Administration Systems, p. 43)*

5.3.3 ERP Status at SSO_II

To review the research propositions related to the ERP implementation, it is vital to analyse where SSO_II is positioned in the ERP lifecycle phases and stages. This is analysed in this section in terms of ERP suppliers, action plan stage, infrastructure development, efforts made to streamline the business process and any existing pre-implementation limitations. The middle managers of the SSO_II responded that their organisation has successfully implemented ERP and that their organisation is in the benefits realisation stage. SSO_II has completed the ERP adoption and implementation activities and now, all sections of the organisations are using ERP as a main technical platform and core of their entire business process. Archival documents do not reveal the actual cost of ERP implementation for the organisation. However, the maintenance cost per year is approx.15 millions Saudi Riyals. For SSO_II, the ERP solution was supplied and installed by Oracle.

5.3.3.1 Pre-ERP IT Infrastructure

SSO_II was not using any integrated system and organisational hierarchy was operating in the traditional top down approach, which made business process integration complex and corporate communication chain even longer. Any communication had to pass through many levels such as vice president, general managers, directors, section heads and specialists before reaching to shop floor employees. On the other hand, SSO_II provides telecom services which in itself are the high end services. The organisation had billing and customers accounts integrated into a module well before ERP adoption. This allowed SSO_II to have control over usage by the customers and revenue. Hence, any upgrade in the technical platform was further advancement of the organisation in terms of skills buildings for employees and staying ahead of competitors to their retain customers by offering them better services.

5.3.3.2 Restructuring Efforts and Integration Process

In 2004, SSO_II initially attempted to implement similar project of Customer Relationship Management (CRM), which was not accomplished and was unsuccessful. The CRM committee sighted the main reason was the lack of readiness to implement such a module. There was also lack of resources and organisational structure was not able to absorb changes at that time. The management viewed CRM as a narrow concept and not as a catalyst to overhaul the organisation in customer centricity. Nevertheless, in 2006 SSO_II again attempted to implement CRM systems. This time it was successful in adopting and implementing CRM. After CRM, ERP is the third adoption and implementation attempt by the SSO_II to revive the competitiveness of their organisation. The pre-ERP systems were not aligned with the strategy and business processes of in the SSO_II. ERP was required as part of the efforts to restructure SSO_II in terms of cultural changes, IT infrastructure development and business process integration. Along with ERP, in the SSO_II had other issues of privatisation and business restructuring, which needed developing resources in terms of human capital and supplies from stable vendors. SSO_II applied process of developing intermediate supplies and seeking from existing vendors for orientation and training of employees while setting up the competency knowledge centre.

5.3.3.3 Pre-Implementation Limitations

Major challenges involved during this development and integration process were users' resistance, information availability and involvement of different departments. This could easily affect the time schedules and vendors management. Challenges in the operations were about obtaining the approvals on the process from IT teams and requirement of a large server capacity for the ERP systems supplied by Oracle. There was lack of a correlation between existing systems such as billing and collection in the organisation prior to ERP. Another initiative was to hire new expert talents required for changing scenario of the organisation and its expansion targets. Main limitations for SSO_II were shortage of skilled human resources, hierarchical communication problems. This included taking long time in high management approvals for allocating financial and human capital resources, scheduling interviews for new employees' recruitment and short listing candidates. Hence, pre-ERP limitations were in the form of organisational inertia, lack of network and infrastructural capabilities, non-alignment between business process and functional departments, lack of skilled staff and slow decision making and lengthy hierarchical communication. Thus, the adoption and implementation of ERP resulted in overcoming the abovementioned organisational and infrastructural limitations.

5.3.4 Assessing the Research Propositions at SSO_II

Similar to SSO_I, the discussions presented earlier for the second case study organisation offer insights to the current ERP status and position of SSO_II based on the secondary published data and managers' responses. The following assessment provides in depth analyses of patterns emerging from primary data from SSO_II. This assessment is done based on the research propositions described in the introduction, initial theoretical proposition and methodology sections. Table 5.21 outlines the research propositions to be investigated in this section for the second case study SSO_II.

Research Propositions	Section in the Interview Responses	Contents Analysed in the Discussion
Research Proposition *1* – as highlighted in Section 5.3.4.1	Section C	Factors Influencing ERP Adoption and Implementation Process.
Research Proposition *2* – as highlighted in Section 5.3.4.2	Section D	Prioritising the Importance of Factors Influencing ERP Adoption and Implementation.
Research Proposition *3* – as highlighted in Section 5.3.4.3	Section E & F	Phases (Section E in Appendix C) and Stages (Section F in Appendix C) of the ERP Adoption and Implementation lifecycle.
Research Proposition *4* – as highlighted in Section 5.3.4.4	Section G	Mapping the Factors Affecting ERP lifecycle Stages.

Table 5.21: SSO_II Research Propositions

5.3.4.1 Assessing Research Proposition 1: Issues and Factors Influencing ERP Adoption and Implementation

This section presents the empirical findings on factors influencing ERP adoption and implementation process at SSO_II.

5.3.4.1.1 ERP Adoption and Implementation Issues

The following analysis of SSO_II pertains to the assessment of adoption and implementation issues in terms of people involved, value of ERP as a product, business process of the company (3Ps model) and its organisational and infrastructural frames.

People: It was top management's idea to invest in ERP as a part of the organisation's business strategy, wherein the management approved the allocation of technical and financial resources. The rest was accomplished by IT department supported by procurement and human resources departments. SSO_II has mixed response in the involvement of stakeholders for the ERP adoption decisions. Because, some executives perceive, it is advantageous to have all stakeholders involved as a matter of maintaining the public interest, ownership interests, whereas other section of managers consider it as self interests of stakeholders which may incline to give the directions to adopt the ERP. Thus, it is advantageous to select the group of stakeholders who are actual users or have an expertise to help in designing the ERP. One can considers these stakeholders as internal customers as their satisfaction post-implementation will be one of ERP performance measure. They are part of the budgetary allocations and can provide required support to sustain changes during all lifecycle stages. However, SSO_II does not seem to consider stakeholders' satisfaction as the main criteria for measuring ERP success. For this, one must know that which type of stakeholders are more critical to ERP implementation success. For this, managers in SSO_II were requested to prioritise the stakeholders according to their relative importance to each other in the ERP implementation success. This prioritisation is shown in Table 5.22.

	INTERVIEWEES AND THEIR RESPONSES										Average of 10
Stakeholders	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	
Top Management	1	1	1	1	3	4	1	2	4	1	1.9 (1)
Project Team	2	2	3	2	4	3	2	1	2	2	2.3 (2)
End Users	4	4	2	3	1	2	3	4	1	3	2.7 (3)
Vendors & External Advisors	3	3	4	4	2	1	4	3	3	4	3.1 (4)

Table 5.22: Stakeholders Priority at SSO_II

Product: The other attribute to analyse the ERP implementation factors is to assess the product's value proposition. This can be in terms of ERP's influence on SWOT factors of the organisation or ERP's direct impacts on BCOR factors. BCOR analysis of SSO_II is about what benefits' this organisation would derive when ERP is successfully implemented, what costs are contained within limits, opportunities that can be generated by implementing ERP and the potential risks stemming from the ERP adoption. The following Table 5.23 presents the BCOR analysis of ERP as a product within SSO_II perspective.

Benefits (B)	**Costs (C)**
• Better management of organisation's assets and increased productivity. • The speed of information exchange and integrative informatics enhances the faster decision making. • Simplified procedure, reduced transaction time and automated business process with employee support will increase the customer satisfaction. This may directly lead to increased revenue and reduce operational costs too. • The decision making of top management will be facilitated by ERP output such as increased information accuracy, speed of services, effective communication, and regular business intelligence reports and reduced paper work.	• Costs increases are in terms of capital outlay for purchase, installation and training with annual maintenance costs. • Other extra costs increases arise from staff cost and any post-implementation substantial design changes.
Opportunities (O)	**Risks (R)**
• This will keep the organisation in line with competitors who have ERP as best practices adoption benchmark in the telecom industry. • Raising the level of education and intelligence in employees will increase the human capital over the time. • Adoption of latest technology would make the organisation eligible for New York or Tadawul KSA stock exchange listings. • With the help of ERP, raw material costs and inventories can be monitored which may allow the price flexibility from reduced inventory costs.	• The major risk is in this organisation being heavily reliant of all processes to be carried out using ERP. This raises another question about back up plan. • Secondly, non-acceptance of the system or resistance in that regard from end users poses the risk of disruptions. • Other risks are huge infrastructure requirements of the system; post-implementation in case of implementation not successful; managing the transition phase of each maintenance and change request.

Table 5.23: BCOR Analysis of ERP as a Product at SSO_II

Process: The process perspective of analysing the ERP implementation factors provides the comprehensive view of what can happen during the ERP implementation at which point. This allows clear distinction between the positive and negative implications of critical success factors. The managerial responses suggest that for SSO_II, the critical success factors during the implementation process are volume of use and reliability of the system, development of the work mechanism, top management support, business support and involvement of stakeholders, project support team, user acceptance and performance enhancement. The factors which can generate negative implications on the ERP adoption process are lack of clarity of requirements, the objective of the system, transformation from the legacy system to the ERP and the knowledge transfer, change management due to the end user resistance to transfer to new process from the existing one. User involvement can be crucial as well because some employees do not know about ERP or do not want to deal with the ERP considering it as a barrier to their role and authority in the organisation. The factors which can have positive effects on the ERP adoption process are value added by the application of ERP, centralised reporting platform which reduced communication channels, project team development for future projects, clear requirements analysis leading to gap analysis for the organisation and top management support.

Organisational Frame: The resources such as dynamic capabilities which allow actual resources such as human capital are integral part of organisational frame. The organisational frame has resources embedded within. The examples are support of intangible resources such as administrative support, top management support and approvals, team dynamics, automated and streamlined business process, data accuracy and information flow, integrated business needs and drivers of technology strategy and implementation. On the other hand, workability of the organisational frame relies on the activities of employees and other stakeholders actions (Zollo and Winter, 2002).

Infrastructural Frame: This comprises the tangible resources as compared to the organisational frame. The infrastructural needs and their analyses facilitate the integration of ERP with the rest of the organisation. This includes integration for the legacy systems and integration between technology platform, hardware and software, business process needs and technology needs (Trimmer *et al.*, 2002; King and Burgess 2006).

From the discussion above, it is evident that no single resource, perspective, factor or stage is the most important. However, their integration with one another and appropriate support and actions from each level of organisational hierarchy makes it a success. The important resources are: readiness to accept new technology, top management and their support, project team, changes in the way employees do a specific job or overall strengthening of business process. SSO_II tends to focus on employee resistance and their satisfaction based on their earlier attempts to introduce such system and technology restructuring in the organisation. Hence, the most important criteria of ERP implementation for SSO_II are employee acceptance of ERP and their knowledge of the system.

5.3.4.1.2 Factors Influencing ERP Adoption and Implementation

Similar to present in SSO_I, this section of the second case study highlights the importance of factors influencing ERP adoption and implementation based on Miles and Huberman's (1994) scale of high (●), medium (⦿) and low (○). Similar, to the case study conducted in SSO_I, during this case study interview sessions as well, each participant was asked to highlight the significance of these factors in their specific context. Results as highlighted in Table 5.24 are based on the general discussions carried out and observation during the interview. Where the interviewees have not responded, the author has termed it as not applicable by using the symbol as '×'.

		INTERVIEWEES AND THEIR RESPONSES									
	Factors Influencing ERP	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**
Stakeholders	Top Management Commitment	●	●	●	●	●	●	○	●	●	●
	Project Champion	●	●	●	⦿	⦿	⦿	●	⦿	○	⦿
	Execution Team	●	⦿	●	●	●	●	⦿	●	●	●
	Qualified IT Staff	⦿	●	●	●	●	●	⦿	●	⦿	●
	External Advisory Support	⦿	⦿	●	●	●	○	○	●	○	○
	Vendor Partnership	●	●	●	⦿	⦿	○	●	●	⦿	⦿
	Total End-User Involvement	●	●	●	●	●	●	●	●	○	●
Process	Business Process Reengineering	●	●	●	⦿	●	●	●	●	●	●
	Customisation Approach	×	●	●	●	○	●	⦿	⦿	⦿	⦿
	Performance Measurement and Control	⦿	●	●	●	●	○	⦿	⦿	⦿	⦿
Technology	IT Infrastructure	⦿	●	●	●	⦿	●	⦿	⦿	●	●
	Package Requirements and Selection	●	●	●	●	●	●	⦿	⦿	⦿	●
	System Testing	●	⦿	●	●	●	●	●	⦿	●	⦿
	System Quality	⦿	●	●	●	●	●	●	○	⦿	⦿
	Information Quality	●	●	●	●	●	⦿	●	○	●	●
Organisation	Business and IT Legacy Systems	○	○	●	⦿	○	×	⦿	○	●	⦿
	Change Management	●	●	●	●	⦿	●	●	⦿	○	○
	Effective Communication	⦿	●	●	●	●	⦿	●	●	○	⦿
	Business Vision Goals and Objectives	●	●	●	●	●	●	⦿	⦿	⦿	⦿

	Training and Education	⦿	⦿	●	●	●	●	●	●	⦿	⦿
	Organisational Structure and Culture	⦿	●	●	⦿	●	⦿	●	⦿	○	⦿
Project	Project Management	●	●	●	●	●	●	⦿	●	⦿	●
	Budget – Cost Parameters	⦿	●	●	●	●	●	●	⦿	●	●
	Time	⦿	●	●	●	⦿	○	○	●	●	●

Table 5.24: Validation of Factors Influencing ERP Adoption and Implementation at SSO_II

Table 5.25 is a summarised version of Table 5.24. Average results highlight the final rank for each factor derived based on all the ten responses. The interpretation provided is based on author's own judgment irrespective of average obtained. This interpretation should not be considered as author's bias but is based on valid rationale evident from the literature, secondary data of SSO_II, and observations made in the SSO_II whilst interviewing managers. The author intends to compare the results of both case studies at the end of this case study, in order to understand the differences and similarities in the outcome of the results. The latter is also accomplished in order to justify the end of the empirical findings (i.e. deciding on not moving onto the third case study).

	Factors Influencing ERP	**High**	**Medium**	**Low**	**N/A**	**Average of Responses**
		Frequency of H, M, L from 10 Responses				
Stakeholders	Top Management Commitment (TMC)	9	–	1	–	H
	Project Champion (PC)	4	5	1	–	M
	Execution Team (ET)	8	2	–	–	H
	Qualified IT Staff (QITS)	7	3	–	–	H
	External Advisory Support (EAS)	4	2	4	–	M
	Vendor Partnership (VP)	5	4	1	–	M
	Total End-User Involvement (TEUI)	9	–	1	–	H
Process	Business Process Reengineering (BPR)	9	1	–	–	H
	Customisation Approach (CA)	4	4	1	1	M
	Performance Measurement and Control (PMC)	4	5	1	–	M
Technology	IT Infrastructure (ITI)	6	4	–	–	H
	Package Requirements and Selection (PRS)	7	3	–	–	H
	System Testing (ST)	7	3	–	–	H
	System Quality (SQ)	6	3	1	–	H
	Information Quality (IQ)	8	1	1	–	H
Organisation	Business and IT Legacy Systems (BITS)	2	3	4	1	L
	Change Management (CM)	6	2	2	–	H
	Effective Communication (EC)	6	3	1	–	H
	Business Vision Goals and Objectives (BVGO)	6	4	–	–	H

	Training and Education (TE)	6	4	–	–	H
	Organisational Structure and Culture (OSC)	4	5	1	–	M
Project	Project Management (PM)	8	2	–	–	H
	Budget – Cost Parameters (BCP)	8	2	–	–	H
	Time (T)	6	2	2	–	H

Table 5.25: Ranking of Factors Influencing ERP Adoption and Implementation at SSO_II

The findings from the primary data and author's interpretation demonstrate that most of the factors influencing the decision making process for ERP adoption and implementation are highly significant with exception to few that have either low or medium importance. The results presented thus far (as also mentioned earlier) in Table 5.24 and 5.25 (same as the case with SSO_I) are merely based on general discussions during the interview sessions, interviewees understanding on ERP systems and author's observation during the interview sessions. The author denotes that these results may not seem adequate because these results are based on each interviewee's observation and understanding. The author argues here that simply by conversing on factors and accomplishing the vocal responses during the interview session, it may be unlikely to identify the particular significance of each factor. Nevertheless, the understanding from this ranking offers some insights as to how to adopt and implement ERP systems. Despite this, the author considers that this is not adequate and aspires to present a proper of factors with the highest importance to the least importance. The author considers that this process will save time of the management whilst taking their decisions for ERP adoption and implementation. Due to this rationale and to improve the research, the author focused on prioritising the importance of factors using an AHP technique. This technique along with its utilisation is highlighted in the following section.

5.3.4.2 Assessing Research Proposition 2: Prioritising the Factors Influencing ERP Adoption and Implementation

In the previous section, the author highlighted the importance of factors based on Miles and Huberman's (1994) scale; however, as argued this may not be enough to justify the importance of factors influencing ERP adoption and implementation in SSOs. The author takes a step forward and employs the AHP technique to precisely prioritise the factors based on their importance sighted by the top management at SSO_II. In so doing, ranking of factors from the most important to the least important is provided herein. In order to prioritise the factors, however, a sequential and iterative procedure is followed for the responses received from each interviewee. This section of the interview in the primary data collection and analysis applies the AHP technique steps to calculate the final priority level of each factor using a nine-point scale (as illustrated in Table 4.7).

Literature highlights that AHP enables decision-makers to form an intricate problem in a hierarchical structure demonstrating the core affiliations of the goal, objectives (criteria), sub-objectives, and alternatives including four fundamental stages that are described as follows:

- **Step 1 – *The Hierarchy Model:*** The first step in studying the importance of factors influencing ERP adoption and implementation in SSOs is to develop the ERP adoption and implementation factors' hierarchy model. The author has explained this step in detail in Section 4.5.3.3.

- **Step 2 – *Data Collection through Pairwise Comparison:*** Similarly, in this case study also, the interviewees were explained on how to conduct the pairwise comparison between each factor. The assessment of the importance of factors can be made instinctively and changed to a mathematical value using a pair-wise comparison scale. The mathematical values demonstrating the assessment of the comparisons are put in order in a matrix for further computation. The author demonstrates only one matrix as presented in Table 5.26 for the first interviewee Vice President of Information Technology (VP_IT). The remaining nine matrixes for other nine interviewees follow the same pattern and are presented in Appendix D. Table 5.26 presents the initial set of data collected from interviewees. For example, note the reciprocals across the diagonal i.e. (top management commitment/project champion) is 9, while (project champion/top management commitment) is 1/9.

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table 5.26: Individual Normalised Numerical Ranking of Factors by VP_IT

- **Step 3 – *Determine Normalised Priority (Local) Weights:*** The third step is to determine the individual normalised priority (local) weights of all the factors. For this purpose, the author used the same Expert Choice software to compute the weights of the factors. Table 5.27 presents the individual normalised ranking of factors (in their specific category) by all interviewees (each column signifies an individual interviewee).

		INTERVIEWEES AND THEIR RESPONSES – LOCAL WEIGHTS									
	Factors Influencing ERP	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**
Stakeholders	Top Management Commitment	0.309	0.471	0.118	0.268	0.463	0.401	0.034	0.206	0.454	0.45
	Project Champion	0.059	0.163	0.076	0.073	0.198	0.049	0.068	0.027	0.14	0.201
	Execution Team	0.136	0.107	0.316	0.07	0.131	0.246	0.162	0.106	0.19	0.13
	Qualified IT Staff	0.096	0.092	0.084	0.11	0.087	0.147	0.1	0.238	0.11	0.092
	External Advisory Support	0.168	0.07	0.218	0.108	0.057	0.024	0.025	0.049	0.048	0.031
	Vendor Partnership	0.116	0.054	0.04	0.13	0.038	0.032	0.225	0.038	0.033	0.027
	Total End-User Involvement	0.116	0.042	0.148	0.241	0.026	0.1	0.387	0.337	0.024	0.069
Process	Business Process Reengineering	0.627	0.528	0.268	0.474	0.705	0.163	0.683	0.4	0.691	0.804
	Customisation Approach	0.094	0.333	0.117	0.149	0.211	0.54	0.2	0.2	0.218	0.074
	Performance Measurement and Control	0.28	0.14	0.614	0.376	0.084	0.297	0.117	0.4	0.091	0.122
Technology	IT Infrastructure	0.193	0.442	0.111	0.186	0.48	0.033	0.035	0.161	0.406	0.361
	Package Requirements and Selection	0.186	0.334	0.035	0.078	0.241	0.296	0.464	0.194	0.3	0.039
	System Testing	0.215	0.052	0.073	0.285	0.157	0.13	0.087	0.194	0.169	0.274
	System Quality	0.112	0.074	0.299	0.29	0.073	0.072	0.145	0.257	0.078	0.207
	Information Quality	0.294	0.098	0.482	0.16	0.049	0.469	0.269	0.194	0.048	0.119
Organisation	Business and IT Legacy Systems	0.051	0.05	0.026	0.031	0.218	0.041	0.034	0.028	0.034	0.035
	Change Management	0.091	0.217	0.073	0.05	0.092	0.276	0.118	0.041	0.361	0.074
	Effective Communication	0.139	0.195	0.44	0.174	0.169	0.345	0.12	0.066	0.113	0.047
	Business Vision Goals and Objectives	0.312	0.357	0.052	0.231	0.435	0.16	0.257	0.251	0.17	0.426
	Training and Education	0.192	0.109	0.245	0.114	0.052	0.07	0.102	0.45	0.257	0.143
	Organisational Structure and Culture	0.214	0.072	0.163	0.399	0.034	0.108	0.368	0.164	0.065	0.275
Project	Project Management	0.54	0.387	0.655	0.333	0.166	0.279	0.188	0.139	0.705	0.057
	Budget – Cost Parameters	0.163	0.443	0.25	0.14	0.761	0.072	0.731	0.773	0.211	0.578
	Time	0.297	0.169	0.095	0.528	0.073	0.649	0.081	0.088	0.084	0.364

Table 5.27: Normalised Numerical Ranking of Factors

- **Step 4 – *Evaluating and Computing the Priority Weights:*** Based on normalised numerical ranking of factors (i.e. the priority weights) from previous Step 3, the relative priority importance of ERP adoption and implementation factors in a specific category are evaluated and computed in Tables 5.28. These priority weights are obtained by using the EC software and the conclusions drawn from them are the final results of the analysis of collective judgements provided by the panel of interviewees selected for SSO_II. Similar to the results presented in SSO_I, the results presented herein are based on the knowledge, judgement and understanding on the factors by all the interviewees at SSO_II.

	Factors Influencing ERP	Global Weight
Stakeholders	Top Management Commitment	0.317 (1)
	Project Champion	0.105 (5)
	Execution Team	0.159 (2)
	Qualified IT Staff	0.116 (4)
	External Advisory Support	0.080 (6)
	Vendor Partnership	0.073 (7)
	Total End-User Involvement	0.149 (3)
Process	Business Process Reengineering	0.534 (1)
	Customisation Approach	0.214 (3)
	Performance Measurement and Control	0.252 (2)
Technology	IT Infrastructure	0.241 (1)
	Package Requirements and Selection	0.217 (3)
	System Testing	0.164 (4)
	System Quality	0.161 (5)
	Information Quality	0.218 (2)
Organisation	Business and IT Legacy Systems	0.055 (6)
	Change Management	0.139 (5)
	Effective Communication	0.181 (3)
	Business Vision Goals and Objectives	0.265 (1)
	Training and Education	0.173 (4)
	Organisational Structure and Culture	0.186 (2)
Project	Project Management	0.345 (1)
	Budget – Cost Parameters	0.034 (3)
	Time	0.243 (2)

Table 5.28: Global Priority Weight of Factor Influencing ERP Adoption and Implementation

The next research proposition 3 is on phases (Section E in Appendix C for details) and stages (Section F in Appendix C for details) of the ERP Adoption and Implementation lifecycle. This research proposition is discussed in light of the case study and tested for its validity in the context of SSO_II.

5.3.4.3 Assessing Research Proposition 3: ERP Lifecycle Phases and Stages

This section presents the empirical findings of ERP lifecycle phases and implementation stages at SSO_II.

5.3.4.3.1 ERP Lifecycle Phases

To analyse the organisational view of the ERP lifecycle, the author collected the managerial responses and relevant information from SSO_II official documents. Most of the executives agreed with the external view of the ERP that correlates to the macro changes in the external environment of the organisation. This view supported the SSO_II to align and respond to market changes and match their capacity to be at par with industry best practices and or competitors.

Pre-Implementation Phase – I: SSO_II emphasized the ERP availability, business alignment and need analysis in this phase. The pre-implementation activities for SSO_II can be divided into three step action plan:

- reviewing the market;
- assessing the organisation’s business and then compare to what is available in the world; and
- prepare the specifications for what is required within the organisation.

Also, one must review the localisation support such as ERP version availability in Arabic language, ease of use and quality of the after sales support from the vendor (Edwards and Panagiotidis 2000; Kansal, 2007; Upadhyay *et al.,* 2011). The main plan was categorised into quality plan, data, implementation, training, testing and the detailed activities include such as data gathering, mapping, programming functions, administration of end user accounts. This can be illustrated as in Figure 5.3 as the main plan for SSO_II. The main aim of this pre-implementation phase was to select the most appropriate ERP suitable to the organisation needs and comparable to the industry standards set by competitors. The pre-implementation phase I was a year plan for the SSO_II but much depended on priorities and departmental specifications.

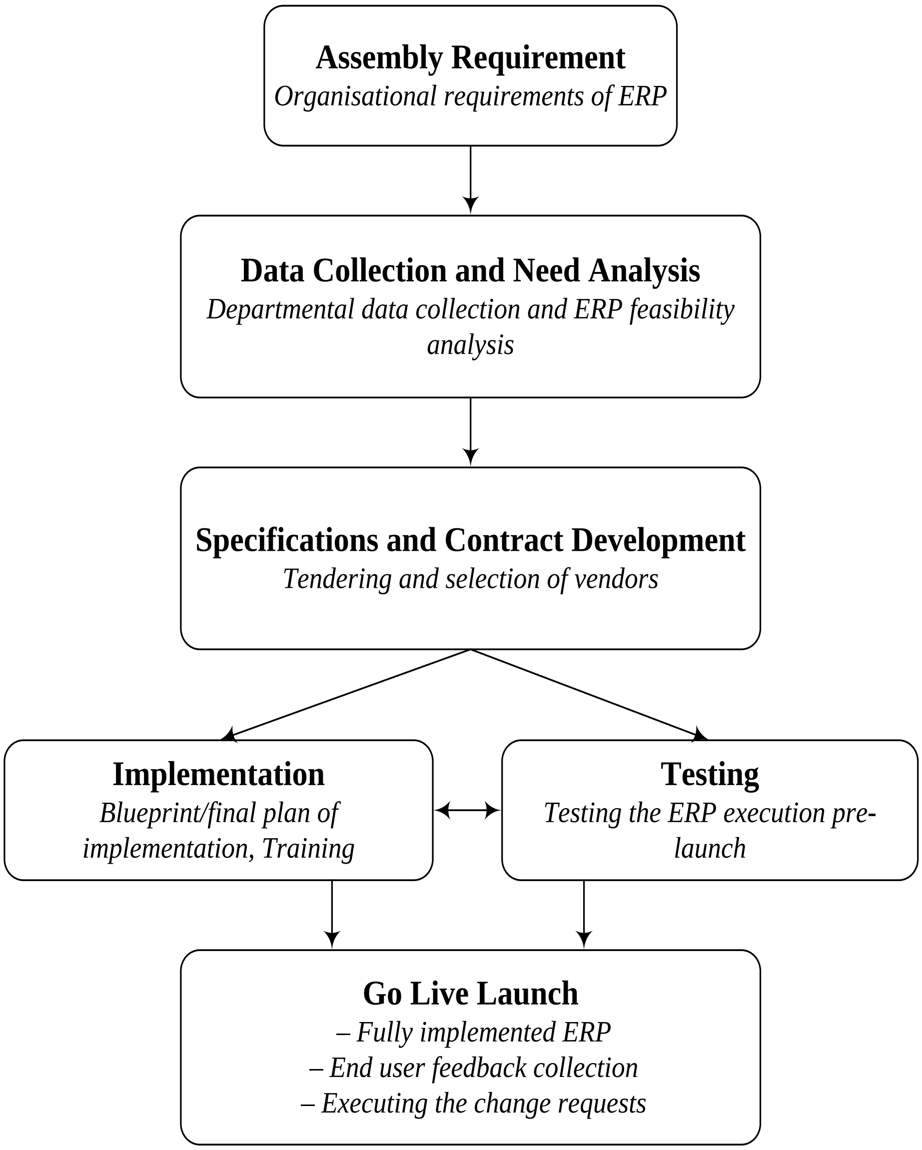

Figure 5.3: Main ERP Implementation Plan for SSO_II

The detailed need analysis was carried out by project team and submitted for steering committee. This committee thereafter reviewing approved the capital budget decisions for adopting ERP solution and all other related expenditures. This steering committee comprised of top management, cross-functional team of departmental heads and employees with special expertise and entrepreneurial spirit, was formed to monitor the progress of the project. In addition, further decisions were made for resources allocation and extending moral and material support to the project implementation. The time line of the project was agreed earlier in the statement of approvals from top management and thereafter contracts were given to suppliers. However, with mutual understanding between SSO_II and their ERP vendors, more time was spent to conduct revisions in the different module specifications over the course of implementation and Go Live phases. SSO_II adopted the same phased approach as was adopted by SSO_I to implement ERP. SSO_II did this due to three reasons:

- Did not want to repeat the earlier experience of CRM implementation,
- Did not want to disrupt their large customer base, and
- To minimise the resources and business process fluctuations.

As on date, SSO_II is yet to finalise the integration of recruitment and HRM modules with the mainframe ERP installed, as this may further take another 12 to 24 months. Two most important factors in the pre-implementation phase for the SSO_II are alignment of business strategy of the company with advantages available and created by ERP and to succeed doing this, the support from top management and their commitment for leadership and timely resource allocation are required. The responses from managers who were engaged directly or indirectly in the ERP implementation suggest that there was strategy for ERP implementation from the point of detailed need analyses but it was not aligned with SSO_II's business strategy. The priorities of business process and IT infrastructure development were different. Therefore, an agreement between needs of IT and other departments was difficult to make. This resulted in project extension beyond the predetermined timeline. The support from management was high and open ended that was crucial for end-to-end streamlining of the ERP adoption and implementation process. Priorities setting and prompt decision making were possible due to the top management support (Wang and Chen, 2006; Nah and Delgado, 2006; Doom *et al.,* 2010).

Even though priorities were agreed in advance, SSO_II allowed the quick changes as and when required. This business mechanism of change request followed the order of study, analysis, testing and implementation of any amended solution. This change mechanism was proved to be more helpful during implementation and Go Live stages which mainly helped in time and cost savings. The advantages targeted for SSO_II were collectively decided by the steering committee. On the other hand, the implementation perspectives were different for each function or department in the SSO_II. Thus, importance given to each different adoption and implementation perspective by managers as shown in Table 5.29 illustrates the complex nature of ERP, its interconnections within the organisation, and impacts on the organisation's operations and functions. Table 5.29 highlights the priority given by each manager in the form of 1 to 5 ranking to each adoption and implementation perspective.

	INTERVIEWEES AND THEIR RESPONSES										Average of 10
Perspective	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	
Stakeholders	5	5	1	1	1	3	1	2	2	2	2.3 (1)
Process	2	1	4	3	4	1	4	3	3	1	2.6 (2)
Technology	4	4	5	2	2	5	5	5	1	5	3.8 (5)
Organisation	3	3	2	5	5	4	3	4	4	3	3.6 (4)
Project management	1	2	3	4	3	2	2	1	5	4	2.7 (3)

Table 5.29: ERP Adoption and Implementation Categories at SSO_II

The abovementioned priority ranking for implementation perspective suggests that SSO_II has multiple targets in adopting ERP. It is evident that SSO_II has emphasized the importance of stakeholders' satisfaction and business process improvement as key targets where as other objectives such as new technology adoption and managing a project has shorter life time compared to priority 1 and 2. Most of the executives agreed that value addition from the operational activities leads to customer satisfaction and corporate image enhancement. The other perspectives of considering ERP as main change agent were to derive competitive advantage through ERP such as technology and business process benefits, increased competing standards and overall customer relationship perspective. This indicates that ERP has enabled the paperless procedures and faster decision making in the organisation as part of its early stage effects (Shang and Seddon 2000; Markus and Tanis 2000).

SSO_II Modules

SSO_I modules are tightly integrated, online and in real time to provide an instantaneous snapshot of the business. The major modules for SSO_II included:

- **Financials**

  The SSO_II Financials module includes Cash Management, General Ledger, Receivables, Payables, Financial Analyser and Property Management. Financials module allow to:

  - Enhance efficiency and decrease back-office expenses with standardised procedures for common services, efficiency tools.
  - Manage the SSO_II global finance.
  - Assist corporate governance and financial control.

- **Human Resource Management System**

  Human Resource module assists SSO_II in managing the entire recruitment process and offers a real-time view of all HR activities such as recruitment, training, benefits and payroll. The HR provides SSO_II an analytics package that permits for simple extraction of HR data.

  HR will enable SSO_II to:

    - Manage payroll, processes and core HR data.
    - Provide performance management, analytical tools and learning applications.
    - Offer transaction and information results efficiently and easily.

- **Logistics**

  SSO_II Logistics module is a tracking system that integrates with and stores information collected from Purchasing, Inventory, Fixed Assets, Project Accounting, and Payables. Logistics module allow to:

    - Control, manage, and plan the flow and storage of products.
    - Produce detailed, material plans and constraint-based production schedules.
    - Provide user admittance to tracking information without letting them admittance to processes associated to purchasing.
    - Track inventory items after they have been installed.

Implementation Phase – II: SSO_II started its ERP implementation process after carrying out a thorough need analysis for the organisation and ERP availability technical and commercial comparisons of offers received from the major suppliers. SSO_II wanted to start from where other competitors stopped augmenting in technological advancements. This initial analysis part was conducted by a team of in-house organisational experts consisting of IT departments and other functional team leaders. Later when complexity increased during specifications design and actual implementation, it largely depended on top management, project team and selected suppliers' consortium. However, to gain knowledge and to reduce future maintenance costs, experienced suppliers' support was preferred over in-house development in these implementation phases and stages (Nah *et al.*, 2003; Garcia-Sanchez and Perez-Bernal, 2007). During the implementation, a good relationship was maintained throughout the installation of initially agreed modules. SBM was the integrator. As decided in the ERP readiness phase, SSO_II followed the five staged implementation procedure consisting main activities in order of: *(a)* planning, *(b)* development, *(c)* implementation, *(d)* testing and *(e)* Go Live.

In addition to this, vendor applied application implementation methodology as a standard procedure to their ERP projects which are considered as software design, development and implementation the IT industry. The implementation process activities had pre-defined control points which were requirement, system qualification test (SQT), preliminary acceptance test (PAT) and then Go Live. The important outcome of implementation phase is the fitting of ERP within the organisational hierarchy, number of departments and creating command and communication structure for ERP. Thus, appropriate restructuring of organisational hierarchy is pre-requisite before their participation in the ERP adoption programme. It is partially fitting within the SSO_II; however, 100% alignment with vision, strategy and departmental goals has not been achieved according to the managerial feedback. Finance, supply chain and marketing were involved the first phase of implementation. This lack of cohesion of ERP within SSO_II may not allow realisation of all targeted benefits. This will be analysed in the subsequent sections of the discussion (Hong and Kim 2002; Raymond and Uwizeyemungu, 2007).

It was reported that ‘Data Migration’ plan must be designed to insure sufficient valid data is available for the Preliminary Acceptance Test (PAT). Sufficient test data is defined as that volume of data which is expected in the production environment. Additionally, transaction test data is usually supplied by the Business User. As the PAT is the final pre-production test stage, the Data Migration must be complete to the extent that is necessary in the expected production environment. This must be reviewed and approved by the Business User - BSS DS may be required. In respect of the PAT, the Vendor_A who is delivering the system will Plan, execute and monitor data migration – provide all necessary tools and templates for data uploads; In respect of the PAT, the Business Users will validate data migration (if applicable). In the case of large testing volumes, the Vendor_A may be required to submit a Data Migration Plan for approval. This will be at the discretion of BSS DS in collaboration with the Business Users. The Vendor_A will be responsible for maintaining the confidentiality of all SSO_II data used I the testing exercise. If a Data Migration Plan is employed, the Vendor_A must include a description of procedures to be taken to insure data security. Conversion requirements must always be agreed with the users’ way ahead of Production

Migration. Whatever is agreed with users must be included in the PAT (refer to document "BSS DS Procedures - PAT.doc") and then included in the production setup. Usually all master data (e.g. suppliers and customers) and opening balances/transactional data (open invoices and open journal balances) are converted during the production setup. The following steps need to be actioned:

- Convert Master Data - specify each conversion element;
- Vendor_A to inform BSS to backup after Master Data conversion is complete and Verify when backup has been completed (including tape numbers);
- Convert Transactional Data - specify each conversion element.

Post-implementation – III: The post-implementation phase importance is in terms of mainly realising the return of investment sought before adoption phase and non-disruptive running of the efficient utilisation of the ERP. The measures of this phase of ERP implementation can be made through business intelligence report and key performance indicators. However, accuracy of report and speed of transaction would determine the actual delivery of these measures. Impacts of measuring the ERP implementation and its benefits can be wide ranging from positive implications such as gap analysis or improvement opportunity to negative implications such as employee resistance or cost of redesigning the components of ERP (Al-Mudimigh, 2001; Loh and Koh, 2004). SSO_II's multiple advantages targeted throughout many functions within the organisation are shown in the Table 5.30. Managers were requested to define the priority for group of these targeted advantages through ERP. The prioritisation process is conducted based on the scale of 1to 6, where 1 is the most important and 6 is the least important. All attributes are equally important but this ranking shows their priority in the achievement through ERP. That is, revealing the gap or need in the SSO_II about where the improvement or restructuring is needed first.

	INTERVIEWEES AND THEIR RESPONSES										
Improvement Target from ERP Implementation	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Average of 10**
Operational Efficiency	2	2	1	3	1	1	1	1	4	1	1.7 (1)
Market Share	6	3	5	6	5	5	6	6	6	6	5.4 (6)
Financial	1	1	2	1	2	3	2	4	3	4	2.3 (2)
Competitive Edge	4	5	4	5	4	2	5	5	5	3	4.2 (4)
Human Capital	3	4	3	2	3	4	3	3	1	2	2.8 (3)
Technical Advantage	5	6	6	4	6	6	4	2	2	5	4.6 (5)

Table 5.30: SSO_II Priority of ERP Benefits

From Table 5.30 it seems that SSO_II is targeting cost efficiency and profit maximisation as first utilisation of ERP. This in turn would need human capital which is the next priority. Other two priorities are the outcome of achieving the first three as they may lead the SSO_II to have competitive advantage over other marketers from adopting new technology. In theory, ‘factors affecting ERP implementation’ and ‘impacts as a result of ERP implementation’ are two distinct perspectives. This is due to factors being input for influencing ERP adoption and implementation procedure where as in the second case, ERP act as an input to influence the business process, operations or overall organisational performance. This can be separated through measuring the development of services provided internally by employees (input factors) and achievement of customer satisfaction from their feedback (output performance). Internal change request system was created to handle issues and report new functions. Customers are able to provide their feedback through e-mail, phone call or it is observed by employees during the dealing. These separate the input level and output level making ERP a crucial link between how organisation achieves efficiency and effectiveness in its end to end business process. To some extent this has not been a clear concept to managers in their responses to author.

5.3.4.3.2 ERP Implementation Stages

The lifecycle phases are defined as macro components of complete adoption programme of ERP whereas stages are the micro components of activity clusters which must be carried out in that particular timeline. It is evident from the list of activities and priorities of managerial actions that all stages are equally important. However, SSO_II considered preliminary acceptance testing (PAT) as one of the most crucial stages in the implementation process. This stage has various activities such as documentation process, implementation and integrated end to end testing and availability of technical and organisational resources. The main challenges during the implementation stages are localisation of ERP system such as having it in Arabic language; business compatibility according to national and organisational culture; data accuracy and priority issues; lack of understanding systems resource and functioning. The importance of each activity in the whole ERP implementation procedure for this SSO_II can be defined as follows. These stages are pre-defined as mentioned in the chapter three of theoretical proposition.

- ***Initiation:*** Need analysis, Vendor selection, Steering committee approvals, Contracts,
- ***Adoption:*** Specifications, design, Implementation blue print, project team finalisation,

- ***Implementation:*** Preliminary acceptance testing, system quality testing,
- ***Shakedown:*** Go-live, change requests raised, conflicts management,
- ***Evolution:*** Monitoring, controlling, making changes, and
- ***Optimisation:*** Re-design, performance and impacts measurement, reviewing strategies.

To avoid any potential challenges creating disruption in any of the above stages, SSO_II deployed the risk management framework which was user oriented and could inform the project team in the shortest possible time. This system can be made workable when employees are fully trained to make use of. Their training might prove less expensive as compared to non-realisation of benefits and targeted advantages. Undermined training initiatives can have their repercussions to the top management decision making as they may not see any improvement either in their people or processes. Thus, activities such as review of requirements, SQT, PAT, training and decision making are cyclic which form the part of the business process and organisational behaviour. During these cycles of activities top management plays a crucial role through encouragement or enforcement. Encouragement belongs to bottom up management approach and enforcement belongs to top down approach. The analyses of the hierarchies are not in the scope of this study.

The decision making steering committee for the project apart from top management had a pre-set contingency plans to be ready for alternative solutions for any risk. The team comprised of key stakeholders such as senior managers, service providers, human resource managers, finance and supply chain users, IT support and system administrator and general managers. Except initial employee resistance and conflict with main supplier near the end of the project, rest of the project duration had a cohesive team dynamics. This was achieved without applying any models to control the business process. The only model utilised was AIM framework of Oracle from Vendor_A. Although, there was no implementation process control framework, the profit protection points were established which can have control over expenses and costs. This would in turn increase the revenue per employee. Apart from this profit is protected by easing the procedural work which can speed up the process, reduce the delivery time and eliminate the paper work. The major results of ERP implementation were simplifying the procedure of business transactions with suppliers and customers, automating business process to an extent so that it can be monitored to a minute scale and increased customer satisfaction because of increased service quality.

ERP implementation was straight forward procedure as evident from the stages defined for the implementation. But, there were instances and causes which could bring the conflicts within the project team and thus, the organisation. The major causes of the conflicts were unclear requirements and involvement of business goals during each stage of implementation. It is difficult to integrate the wider perspective of business with each detailed activity of ERP implementation. In addition to this, employee capabilities, work style, organisational culture, team work disputes, lack of communication and absenteeism played their part to any conflict arose. This is treated by regular identification of responsibilities, periodic meetings, working groups' establishment, effective and timely communication. During implementation stages with changes and conflicts, the important activities in the whole process are testing and meeting all requirements. There no such 'most important activity' since every aspect of the project is important and interrelated. The crucial test of ERP application is the interface where client is expected to either use a part of the system or meet an employee who is using the new system.

Managers of SSO_II were asked to define the level of importance of each proposed stage of ERP lifecycle on scale of high, medium and low. Each stage received total 10 responses. Based on the frequency of the highest received response, the final interpretation about the importance of the stage is made. SSO_II executives have defined the first three stages of initiation, adoption and implementation as more important as compared to the last three stages of the lifecycle. Table 5.31 highlights the responses received from the interviewees in relation to the six ERP lifecycle adoption and implementation stages. As compared to SSO_I where most of the stages were considered as important with few less and medium important, here in this case study there are mixed outcomes from the interview sessions. These findings indicate that the interviewees perhaps do no understand the significance of these stages whilst adoption and implementation a technological solution. The author argues that these stages are intangible but do exist and every organisation has to pass through these or other similar stages.

	INTERVIEWEES AND THEIR RESPONSES									
Lifecycle Stages	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**
Initiation	◉	●	○	◉	●	●	●	●	◉	●
Adoption	●	●	◉	●	●	●	◉	●	◉	◉
Implementation	●	●	●	●	●	●	●	●	◉	●
Shakedown	●	◉	●	●	●	○	○	◉	●	◉
Evolution	◉	◉	◉	◉	○	○	◉	●	○	●
Optimisation	◉	●	○	◉	◉	○	●	◉	●	●

Table 5.31: Validation of ERP Lifecycle Stages Adoption and Implementation at SSO_II

Table 5.32 (as also reported for Table 5.12) illustrates the findings and explanation of the author from findings based on the scale of high (H), medium (M) and low (L), as proposed by Miles and Huberman (1994). The common feedback from managers exemplify that all three out of six stages are important for the successful outcome of deploying ERP in the organisation, whereas, the remaining three were reported with medium significance. However, the most important stages were identified to be within the *pre-implementation* and during the *implementation* as compared to the *post-implementation* (somewhat similar to what is reported in Table 5.12). This is similar to the view of previous research findings in the literature (Markus and Tanis 2000; Al-Mashari *et al.*, 2006; Chang *et al.*, 2008).

Lifecycle Stages	**High**	**Medium**	**Low**	**N/A**	**Final Interpretation**
	Frequency of H, M, L from 10 Responses				
Initiation	6	3	1	–	High
Adoption	6	4	–	–	High
Implementation	9	1	–	–	High
Shakedown	5	3	2	–	Medium
Evolution	2	5	3	–	Medium
Optimisation	4	4	1	–	Medium

Table 5.32: Analysis of ERP Lifecycle Stages Adoption and Implementation at SSO_II

According to the results in Table 5.32, SSO_II emphasize s the importance of design, selection and training rigour rather than Go Live phase. Same is echoed in the literature by (Umble *et al.*, 2003; Somers and Nelson, 2004; Muscatello and Chen, 2008; Upadhyay *et al.*, 2011). This allows project team to rely heavily on the quality of selection and design which would attract minimum changes as more resources might have been spent for these stages (Markus and Tanis, 2000; Al-Mashari *et al.*, 2006). SSO_II executives defined the relative importance of lifecycle stages but they followed the following stages:

- ***Initialisation:*** Assembly requirement, company requirement of ERP,
- ***Need Analysis:*** Data collection, competitive position, ERP feasibility analysis,
- ***Development:*** Selection if vendors, contracting and design specifications,
- ***Implementation:*** Training, blueprint, final plan of implementation,
- ***Testing:*** Testing the ERP execution pre-launch, and
- ***Go Live Launch:*** Fully implemented ERP end users feedback.

Comparing the abovementioned stages as followed by SSO_II with SSO_I, it can be inferred that this organisation has a similar approach to SSO_I in emphasizing the importance of pre-implementation activities. This is advantageous and can work as prototype before actual Go-live stage. Changes and conflicts are easy to resolve as lower costs in early stages as compared to live stages of implementation. The factors influencing the lifecycle stages and implementation are analysed in the next section.

5.3.4.4 Assessing Research Proposition 4: Mapping the Factors Influencing ERP Lifecycle Phases, Stages and Adoption and Implementation

This section presents the empirical findings on the mapping of factors influencing ERP adoption and implementation process at SSO_II. In Section F (Appendix C) of the interview, the participants (i.e. the managers) were asked to perform the mapping of each factor on the ERP lifecycle stages. This section only highlights the mapping of factors by all ten interviewees for the ‘Initiation’ stage as presented in Table 5.33 (for the purpose of explaining the whole process of mapping), the remaining tables for mapping of factors on adoption, implementation, shakedown, evaluation and optimisation stages are presented in Appendix E (these tables also follow the same practice of mapping of factors on ERP lifecycle stages, however, the results are different). Before starting on the process of mapping the factors on the stages, the author explained the interviewees the overall process of conducting the mapping of factors. Subsequently, the interviewees were individually asked to map the factors influencing ERP adoption and implementation on different stages of the ERP lifecycle. The interviewees went through an arduous brainstorming session and mapped the factors (based on its significance) on each stage of the lifecycle. For example, Table 5.33 highlights the mapping of factors for all ten interviewees with the last column demonstrating the outcome of the mapping of factors by the interviewees. A specific factor was considered to be important if 5 or more interviewees selected it in a particular stage and re-tabulated in the final column of each stage. Interviewees then mapped the factors based on their understanding of ERP. The results presented in Table 5.33 are for the initiation stage where from the total of 24, only 14 factors were selected to be significant by most of the interviewees. The results highlight varied findings from the mapping of factors on this stage. The outcome of mapping can be attributed to the understanding and reflection of each interviewee during their respective ERP projects.

		INTERVIEWEES AND THEIR MAPPING THE INITIATION STAGE										
	Factors Influencing ERP	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Results**
Stakeholders	Top Management Commitment	✓	✓	✓	–	✓	✓	✓	–	✓	✓	8/10
	Project Champion	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Execution Team	–	–	✓	✓	–	–	–	–	✓	✓	4/10
	Qualified IT Staff	–	✓	✓	–	✓	–	–	–	–	✓	4/10
	External Advisory Support	✓	✓	✓	–	✓	✓	✓		✓	–	7/10
	Vendor Partnership	✓	✓	✓	–	✓		✓	✓	✓	–	7/10
	Total End-User Involvement	–	✓	✓	✓	–	✓	✓	✓	✓	–	7/10
Process	Business Process Reengineering	–	–	–	–	✓	✓	–	✓	✓	–	4/10
	Customisation Approach	–	✓	✓	–	–	–	–	–	✓	–	3/10
	Performance Measurement and Control	–	✓	–	–	–	–	–	–	✓	–	2/10
Technology	IT Infrastructure	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	Package Requirements and Selection	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	System Testing	–	–	–	–	–	–	–	✓	✓	–	2/10
	System Quality	–	✓	–	–	✓	✓	–	–	–	–	3/10
	Information Quality	–	✓	–	–	✓	✓		√		–	4/10
Organisation	Business and IT Legacy Systems	✓	✓	–	✓	–	✓	✓	✓	✓	–	7/10
	Change Management	–	✓	–	–	–	–	✓	–	✓	√	4/10
	Effective Communication	–	✓	✓	✓	✓	✓	✓	–	✓	–	7/10
	Business Vision Goals and Objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Training and Education	–	✓	–	✓	–	–	–	–	✓	–	3/10
	Organisational Structure and Culture	–	✓	✓	✓	✓	✓	–	✓	✓	✓	8/10
Project	Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Budget – Cost Parameters	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	9/10
	Time	✓	✓	✓	✓	✓	✓	✓	–	✓	–	8/10

Table 5.33: Mapping the Factors on the Initiation Stage at SSO_II

On the other hand, Table 5.34 presents the end results of mapping of factors for all the stages. Factors as highlighted in grey (i.e. with 5 or more responses) are those that are finally selected and considered as the most vital factors, the remaining factors are discarded (i.e. with 4 or less responses). In the latter case, the factors were considered with limited influence or did not influence the decision-making process on a specific stage. For example in the initiation stage, top management commitment received a response rate of 10/10 i.e. all interviewees considered it as a vital factor, whereas, in the optimisation stage, this factor received 4/10 responses. Thus, it was not selected in the optimisation stage.

		ERP Lifecycle Stages					
	Factors Influencing ERP	**Initiation**	**Adoption**	**Implementation**	**Shakedown**	**Evaluation**	**Optimisation**
Stakeholders	Top Management Commitment	8/10	6/10	3/10	3/10	1/10	2/10
	Project Champion	10/10	10/10	10/10	6/10	7/10	3/10
	Execution Team	4/10	5/10	9/10	6/10	6/10	6/10
	Qualified IT Staff	4/10	4/10	8/10	7/10	6/10	6/10
	External Advisory Support	7/10	2/10	5/10	2/10	2/10	4/10
	Vendor Partnership	7/10	5/10	5/10	4/10	5/10	7/10
	Total End-User Involvement	7/10	6/10	8/10	6/10	7/10	7/10
Process	Business Process Reengineering	4/10	5/10	6/10	2/10	3/10	5/10
	Customisation Approach	3/10	4/10	5/10	4/10	7/10	6/10
	Performance Measurement and Control	2/10	2/10	6/10	3/10	7/10	7/10
Technology	IT Infrastructure	9/10	6/10	7/10	3/10	3/10	2/10
	Package Requirements and Selection	9/10	4/10	1/10	0/10	0/10	1/10
	System Testing	2/10	1/10	7/10	3/10	5/10	4/10
	System Quality	3/10	0/10	4/10	5/10	10/10	5/10
	Information Quality	4/10	2/10	7/10	3/10	7/10	7/10
Organisation	Business and IT Legacy Systems	7/10	2/10	3/10	2/10	1/10	3/10
	Change Management	4/10	4/10	7/10	5/10	9/10	6/10
	Effective Communication	7/10	7/10	8/10	8/10	8/10	7/10
	Business Vision Goals and Objectives	10/10	6/10	2/10	1/10	3/10	4/10
	Training and Education	3/10	2/10	5/10	4/10	8/10	4/10
	Organisational Structure and Culture	8/10	6/10	7/10	3/10	2/10	2/10
Project	Project Management	10/10	10/10	10/10	10/10	8/10	8/10
	Budget – Cost Parameters	9/10	3/10	2/10	1/10	2/10	4/10
	Time	8/10	7/10	9/10	6/10	6/10	6/10

Table 5.34: Final Results of Mapping the Factors from all Stage of ERP Lifecycle at SSO_II

In line with the discussion carried out for Table 5.34, the author summarises all those factors that received 5 or more responses in 5.35 to 5.40 along with their priority weights.

Factors Categories	Summary of Factors Influencing ERP in Initiation Stage	Priority Weights
Stakeholders	Top Management Commitment	0.317 (1)
	Total end-user involvement	0.149 (2)
	Project Champion	0.105 (3)
	External Advisory Support	0.080 (5)
	Vendor Partnership	0.073 (6)
Technology	IT Infrastructure	0.241 (1)
	Package Requirements and Selection	0.217 (2)
Organisation	Business Vision Goals and Objectives	0.265 (1)
	Organisational Structure and Culture	0.186 (2)
	Effective Communication	0.181 (3)
	Business and IT Legacy Systems	0.055 (4)
Project	Project Management	0.345 (1)
	Time	0.243 (2)
	Budget – Cost Parameters	0.034 (3)

Table 5.35: Initiation Stage – Summary of Factors with Priority Weights at SSO_II

Factors Categories	Summary of Factors Influencing ERP in Adoption Stage	Priority Weights
Stakeholders	Top Management Commitment	0.317 (1)
	Execution Team	0.159 (2)
	Total End-User Involvement	0.149 (3)
	Project Champion	0.105 (4)
	Vendor Partnership	0.073 (5)
Process	Business Process Reengineering	0.534 (1)
Technology	IT Infrastructure	0.241 (1)
Organisation	Business Vision Goals and Objectives	0.265 (1)
	Organisational Structure and Culture	0.186 (2)
	Effective Communication	0.181 (3)
Project	Project Management	0.345 (1)
	Time	0.243 (2)

Table 5.36: Adoption Stage – Summary of Factors with Priority Weights at SSO_II

Factors Categories	Summary of Factors Influencing ERP in Implementation Stage	Priority Weights
Stakeholders	Execution Team	0.159 (1)
	Total End-User Involvement	0.149 (2)
	Qualified IT Staff	0.116 (3)
	Project Champion	0.105 (4)
	External Advisory Support	0.080 (5)
	Vendor Partnership	0.073 (6)
Process	Business Process Reengineering	0.534 (1)
	Performance Measurement and Control	0.252 (2)
	Customisation Approach	0.214 (3)
Technology	IT Infrastructure	0.241 (1)
	Information Quality	0.218 (2)
	System Testing	0.164 (3)
	System Quality	0.161 (4)
Organisation	Organisational Structure and Culture	0.186 (1)
	Effective Communication	0.181 (2)
	Training and Education	0.173 (3)
	Change Management	0.139 (4)
Project	Project Management	0.345 (1)
	Time	0.243 (2)

Table 5.37: Implementation Stage – Summary of Factors with Priority Weights at SSO_II

Factors Categories	Summary of Factors Influencing ERP in Shakedown Stage	Priority Weights
Stakeholders	Execution Team	0.159 (1)
	Total End-User Involvement	0.149 (2)
	Qualified IT Staff	0.116 (3)
	Project Champion	0.105 (4)
Technology	System Quality	0.161 (1)
Organisation	Effective Communication	0.181 (1)
	Change Management	0.139 (2)
Project	Project Management	0.345 (1)
	Time	0.243 (2)

Table 5.38: Shakedown Stage – Summary of Factors with Priority Weights at SSO_II

Factors Categories	Summary of Factors Influencing ERP in Evolution Stage	Priority Weights
Stakeholders	Execution Team	0.159 (1)
	Total End-User Involvement	0.149 (2)
	Qualified IT Staff	0.116 (3)
	Project Champion	0.105 (4)
	Vendor Partnership	0.073 (5)
Process	Performance Measurement and Control	0.252 (1)
	Customisation Approach	0.214 (2)
Technology	Information Quality	0.218 (1)
	System Testing	0.164 (2)
	System Quality	0.161 (3)
Organisation	Effective Communication	0.181 (1)
	Training and Education	0.173 (2)
	Change Management	0.139 (3)
Project	Project Management	0.345 (1)
	Time	0.243 (2)

Table 5.39: Evolution Stage – Summary of Factors with Priority Weights at SSO_II

Factors Categories	Summary of Factors Influencing ERP in Optimisation Stage	Priority Weights
Stakeholders	Execution Team	0.159 (1)
	Total End-User Involvement	0.149 (2)
	Qualified IT Staff	0.116 (3)
	Vendor Partnership	0.073 (4)
Process	Business Process Reengineering	0.534 (1)
	Performance Measurement and Control	0.252 (2)
	Customisation Approach	0.214 (3)
Technology	Information Quality	0.218 (1)
	System Quality	0.161 (2)
Organisation	Effective Communication	0.181 (1)
	Change Management	0.139 (2)
Project	Project Management	0.345 (1)
	Time	0.243 (2)

Table 5.40: Optimisation Stage – Summary of Factors with Priority Weights at SSO_II

The dual comparison of mapping and prioritisation (as presented in Tables 5.35 to 5.40) generates an interesting debate about few of the factors and makes it easier to distinguish between less critical and most critical success factors influencing ERP adoption and implementation (this is similar to data presented in SSO_I). Tables 5.35 to 5.40 explain the priority weights (global) based prioritisation of factors influencing ERP adoption and implementation. They are calculated as an average of the aggregate values derived for all interviewees. The prioritisation levels shown in Tables 5.35 to 5.40 are valid with an underlying assumption that all factors are active. The mapping column shows that a particular factor is considered as influential in the stages it is mapped or found active for this SSO_II by the interviewees.

The findings of the SSO_I as presented in abovementioned tables are compared with the results of SSO_II at the next section.

5.4 Comparing the Findings of SSO_I and SSO_II

In this section, the author compares the findings of both the case studies. This comparison provides a detailed understanding about the case study's past experience and current status on ERP adoption and implementation. It highlights the strategic view of the two case studies along with the measure of success achieved in ERP adoption and implementation.

5.4.1 Pre-Implementation Position

The pre-implementation position of both the cases – SSO_I and SSO_II was deemed as somewhat similar. For example, in both the organisations their legacy systems were not appropriately congruent and compatible with the organisations' long term goals. In the past, both the case studies had not explored the possibility of employing ERP or CRM integrated systems to compete with the market trends but instead, were operating with support from their legacy systems. With the rapid change in technological innovations and competitiveness in the market, both the case studies were compelled to bring change in their IT infrastructure and accordingly improve their operation and activities. In doing so, it became necessary for both the organisations to reduce their business process complexities and increase competitiveness wherein planning and operations of the firm are in sync, comprehensive and under complete control of the management. Thus, IS and technological restructuring was highly essential for both the organisations in order to compete in the market with their competitors. On the other hand, both the organisations needed organisational restructuring due to privatisation and streamlining of their business functions and subsidiaries. Based on the overall analysis the market position of the organisations, ERP systems adoption and implementation was considered as a strategic issue with higher importance that could assist them in strengthening the businesses, in addition to automated business transactions and reports. The empirical findings and self observation clearly indicated that the organisational executives from both the cases voiced similar concerns over pre-ERP positions and thus, utilised their allocated resources to adopt and implement ERP systems in their case studies.

5.4.2 Organisational Structure and Infrastructure

At SSO_I, the organisational structure was centralised, followed the top-down management approach and was based on un-integrated multi-systems. SSO_I comprised of multiple applications including finance, human resources, aviation and ticketing networked to a main frame but their interfaces were built on ad hoc basis rather than as an integrated interface. In order to improve their operations internally and services externally, SSO_I targeted streamlining its organisational structure from only service based functions to creating three core business segments and two supporting service units. To facilitate the privatisation plan overhaul restructuring of IT infrastructure was necessary. Changes in the basic infrastructure services such as hardware, connectivity, telecommunication network and platform were necessary for both SSO_I and SSO_II to increase their sustainability and competitiveness across their subsidiaries and holding organisation. On the other hand, SSO_II adopted a rather more advanced approach as compared to SSO_I by introducing the 'FORWARD' model of customer centricity to enhance the consumer experiences whilst supporting SSO_II to achieve its overall operational efficiencies.

5.4.3 Scope of ERP Adoption and Implementation

SSO_I has its scope of ERP covering for end-to-end implementation process that in turn will have positive implications for cost, efficiency, paper work, communication, business process, technology and all possible stakeholders' satisfaction. Thus, scope of ERP for SSO_I was organisation-wide, which has its stakeholders spanning from top management to operational executives to customers and suppliers. For example, many techniques such as slice and dice concept, conditional reporting as a part of ERP training by SAP to SSO_I increased the scope of ERP. In the same manner, SSO_II had variety of Oracle applications deployed as components of ERP and business support system, which covered employees and clients of SSO_II as well. The scope of ERP for SSO_II has profound effects on the business intelligence and management control thereby increasing agility and success of the organisation.

5.4.4 Master Plan and Implementation Approach

SSO_I had more than 18 objectives with a long project process in their master plan of ERP implementation that could have resulted in increased complexities. This also could have been the reason for employee resistance, for the conflict at a later stage with main supplier and requirement of large and detailed change management programme. Since, the plan was large the change requests have become payable from initial stages that can be major disadvantage or a barrier in streamlining all components of business process. This was not the case in the second case study. SSO_II had a comparably easier and straight forward implementation process, whereas, SSO_I is yet to install two of its major modules. SSO_II followed the master plan approach consisting of ten steps with first two steps – planning the work and next eight steps – working the plan. With every step, it increased the complexity of the implementation project process. This, however, illustrates that SSO_I has given much importance and allocated more resources for actual implementation of ERP and post-implementation management and control. Similar findings are evident from the managers' feedback on the important activities in each phase as well stage of ERP adoption and implementation process. The ERP landscape was divided into two segments of back and front office for ease of business process streamlining. Both the case studies selected a consortium of suppliers to supply ERP related modules, hardware, training and advisory support.

5.4.5 Main Activities and Importance of ERP Lifecycle and Categories

SSO_I divided various activities into six stages of initialisation, blueprint, realisation, testing, Go Live and support. However, managers confirmed that stakeholders' satisfaction and business process restructuring had higher priority level as compared to changes in the organisational structure and support functions of technology and project management. As mentioned in importance of lifecycle stages, SSO_I placed higher emphasis on adoption, implementation, shakedown and evolution as compared to initiation and optimisation. SSO_I gave less importance to the first and the last stage that could result into less efficient design and non-realisation of benefits. Within the stakeholders group, organisation's executives placed higher emphasis on top management and project team rather than end users and vendors. This type of decision can again cause a conflict or have further negative implications.

SSO_II also made same decisions regarding stakeholders' importance. Top management support and commitment is necessary for leadership, strategic direction and resources allocation approvals. However, negligible importance to end users and vendors can cause conflicts and resistance to the new systems adoption. SSO_II divided their activities into six groups of: *assembly requirement*, *need analysis*, *design and contracts development*, *testing*, *implementation* and *go-live launch*. Both case studies adopted a phased approach of implementation rather than a big bang approach. SSO_I major targets for implementing ERP were operational efficiency, financial advantage and competitive edge, whereas, SSO_II targeted human capital with a high priority compared to competitive edge. However, SSO_I may need human capital advantage to become competitive and SSO_II will become competitive eventually, if they can derive increased benefits from ERP and business intelligence trained employees. Thus, both case studies have similar benefits and views over ERP benefits.

5.4.6 Comparing the Outcome of Four Dimensions of the Conceptual Model

From the overall empirical analysis conducted thus so far, it is evident that the conceptual model is tested through both the case studies. The latter argument is also supported by the fact that most of the interviewees from both the case studies provided full support and consent in the overall relevance of the conceptual model in the context of their case study. The author argues herein on the basis of the findings extrapolated from the testing of the four research propositions (i.e. the four dimensions – factors, prioritisation of factors, lifecycle phases and stages and mapping of factors) in both the case studies. As the empirical findings from both the case studies illustrate marginal differences, through testing the model, this is what lead the author to take the decision to stop at this point and not to conduct the third case study. The author perceives that in conducting a third case study would also have given somewhat similar results. Following Tables 5.41 to 5.44, clearly indicate the similarities and differences in relation to the four dimension of the conceptual model. These differences and similarities are also reflected in the revised conceptual model as part of Chapter Six.

Conceptual Model Dimensions	SSO_I	SSO_II	Similarities	Differences
ERP Adoption and Implementation Factors	• **High Factors:** TMC, ET, QITS, VP, TEUI, BPR, ITI, PRS, ST, SQ, IQ, CM, BVGO, EC, TE, OSC, PM, and BCP. • **Medium Factors:** PC, EAS, PMC, and T.	• **High Factors:** TMC, PC, ET, QITS, TEUI, BPR, ITI, PRS, ST, SQ, IQ, CM, BVGO, EC, TE, PM, BCP and T. • **Medium Factors:** PC, EAS, VP, CA, PMC and OSC.	Both case studies have: • 17 **high factors** that are: TMC, PC, ET, QITS, TEUI, BPR, ITI, PRS, ST, SQ, IQ, CM, BVGO, EC, TE, PM and BCP. • 3 **medium factors** that are: PC, EAS	T factor was medium important in SSO_I, whereas, it was highly important in SSO_II. Also VP and OSC factors were highly important in SSO_I whereas were medium important in SSO_II. Finally, CA factor was low

	• **Low Factors:** CA and BITS.	• **Low Factors:** BITS	and PMC. • 1 **low factor** was BITS.	important in SSO_I whereas was medium important in SSO_II.

Table 5.41: Similarities and Differences in SSO_I and SSO_II with regards to Factors

Conceptual Model Dimensions	SSO_I	SSO_II	Similarities	Differences
Prioritising the Importance of Factors	The most important factor to least important factor • Stakeholder Category was: TMC (0.346), ET (0.151), VP (0.124), TEUI (0.117), PC (0.112), QITS (0.107), and EAS (0.076). • Process Category was: BPR (0.633), PMC (0.208), and CA (0.160) • Technology Category was: IQ (0.238), ITI (0.231), ST (0.225), SQ (0.156), and PRS (0.151). • Organisation Category was: BVGO (0.127), CM (0.213), TE (0.190), OSC (0.146), EC (0.275), and BITS (0.049). • Project Category was: PM (0.525), BCP (0.296), T (0.179).	The most important factor to least important factor • Stakeholder Category was: TMC (0.317), ET (0.159), TEUI (0.149), QITS (0.116), PC (0.105), EAS (0.080), and VP (0.073). • Process Category was: BPR (0.534), PMC (0.252), and CA (0.214) • Technology Category was: ITI (0.241), IQ (0.218), PRS (0.217), ST (0.164), and SQ (0.161). • Organisation Category was: EC (0.181), OSC (0.186), BVGO (0.265), TE (0.173), CM (0.139), and BITS (0.055). • Project Category was: PM (0.345), T (0.243), BCP (0.034).	TMC was the most important factor as compared to ET and PC was same position in fifth factor in both Case studies. PR was the most important then PMC and least important factor was CA ITI and IQ were the most important factors BITS was least important factor and TE was medium important factors in both Case studies. PM was the most important factor in both Case studies	VP was medium important factor in SSO_I, whereas, least important factor in SSO_II No differences PRS was least important factor in SSO_I, whereas, was medium important factor in SSO_II EC and OSC were the low important factors in SSO_I where as were the most important factors in SSO_II. Also, BVGO and CM where the most important factor in SSO_I where as were medium important factors in SSO_II BCP was medium important factor in SSO_I where as was least important factor in SSO_II. Also, T was least important factor in SSO_I where as was medium important factor in SSO_II.

Table 5.42: Similarities and Differences in SSO_I and SSO_II with regards to Prioritisation of Factors

Conceptual Model Dimensions	SSO_I	SSO_II	Similarities	Differences
Adoption and Implementation Lifecycle Phases and Stages	**High Lifecycle Stages:** • Initiation • Adoption • Implementation • Shakedown • Evolution **Medium Lifecycle Stages:** • Optimisation **Low Lifecycle Stages:**	**High Lifecycle Stages:** • Initiation • Adoption • Implementation **Medium Lifecycle Stages:** • Shakedown • Evolution **Low Lifecycle Stages:** • Optimisation	Both Case studies have 3 high lifecycle stages which are: • Initiation • Adoption • Implementation	Shakedown and Evolution lifecycle stages were high important in SSO_I where as were medium important in SSO_II. Also Optimisation lifecycle stage was medium important in SSO_I where as was low important in SSO_II.

Table 5.43: Similarities and Differences in SSO_I and SSO_II with regards to Adoption and Implementation Lifecycle Phases and Stages

Conceptual Model Dimensions	SSO_I	SSO_II	Similarities	Differences
Mapping of Factors	**Initiation Stage:** TMC, PC, QITS, EAS, ITI, PRS, BVGO, EC, OSC, PM and BCP. **Adoption Stage:** TMC, PC, ET, QITS, VP, BPR, ITI, PRS, BITS, CM, BVGO, EC, TE, OSC, PM, BCP and T. **Implementation Stage:** TMC, PC, ET, QITS, EAS, VP, TEUI, BPR, CA, PMC, ITI, ST, SQ, IQ, BITS, CM, EC, TE, OSC, PM, BCP and T **Shakedown Stage:** TMC, PC, ET, QITS, VP, TEUI, PMC, ST, SQ, CM, TE, OSC, PM and T. **Evolution Stage:** TMC, PC, ET, QITS, VP, TEUI, PMC, SQ, IQ, CM, EC and PM. **Optimisation Stage:** PC, ET, QITS, VP, TEUI, BPR, PMC, SQ, IQ, CM, EC, TE and PM.	**Initiation Stage:** TMC, PC, EAS, VP, TEUI, ITI, PRS, BITS, BVGO, EC, OSC, PM, BCP and T. **Adoption Stage:** TMC, PC, ET, VP, BPR, TEUI, ITI, BVGO, EC, OSC, PM and T. **Implementation Stage:** PC, ET, QITS, EAS, VP, TEUI, BPR, CA, PMC, ITI, ST, SQ, IQ, CM, EC, TE, OSC, PM and T. **Shakedown Stage:** PC, ET, QITS, TEUI, SQ, CM, EC, PM and T. **Evolution Stage:** PC, ET, QITS, VP, TEUI, CA, PMC, ST, SQ, IQ, CM, EC, TE, PM and T. **Optimisation Stage:** ET, QITS, VP, TEUI, BPR, CA, PMC, SQ, IQ, CM, EC, PM and T.	**Initiation Stage:** TMC, PC, EAS, ITI, PRS, BVGO, EC, OSC, PM and BCP. **Adoption Stage:** TMC, PC, ET, VP, BPR, ITI, BVGO, EC, OSC, PM and T. **Implementation Stage:** PC, ET, QITS, EAS, VP, TEUI, BPR, CA, PMC, ITI, ST, SQ, IQ, CM, EC, TE, OSC, PM and T. **Shakedown Stage:** PC, ET, QITS, TEUI, SQ, CM, PM and T. **Evolution Stage:** PC, ET, QITS, VP, TEUI, PMC, SQ, IQ, EC, TE and PM. **Optimisation Stage:** ET, QITS, VP, TEUI, BPR, PMC,	**Initiation Stage:** QITS was mapped in SSO_I, whereas, VP, TEUI, BITS and T were mapped in SSO_II. **Adoption Stage:** QITS, PRS, BITS, CM and BCP were mapped in SSO_I, whereas, TEUI and TE were mapped in SSO_II. **Implementation Stage:** TMC, BITS and BCP were mapped in SSO_I **Shakedown Stage:** TMC, VP, PMC, TE and OSC were mapped in SSO_I, Whereas, EC was mapped in SSO_II **Evolution Stage:** TMC was mapped in SSO_I, whereas, CA, ST, TE and T were mapped in SSO_II. **Optimisation Stage:** PC and TE were mapped in SSO_I, whereas, CA and T were mapped in SSO_II

			SQ, IQ, CM, EC and PM.	

Table 5.44: Similarities and Differences in SSO_I and SSO_II with regards to Mapping of Factors

5.5 Conclusion

Chapter Five presented research findings of the ERP adoption and implementation practices by two service sector organisations, namely SSO_I and SSO_II. Empirical data were collected through different sources such as organisations' official websites, annual reports, white papers, semi-structured interviews, observation and documentation from these case studies. This data was collected to test ERP adoption and implementation conception model which include the: *(a)* factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* ERP adoption and implementation lifecycle phases and stages, and (d) mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages. Empirical data were collected until there was as much as necessary data to test ERP adoption and implementation model. As highlighted in Tables (5.41, 5.42, 5.43 and 5.44) several factors and the adoption and implementation lifecycle stages were validated during the case studies, therefore, supporting the author's literature findings on ERP adoption and implementation factors and adoption and implementation lifecycle phases and stages in Chapter Three. The Empirical data collected from the two case studies was confirmed to be significance, thus, selecting another case study would have afford relatively similar results.

Empirical data from the two case studies state that the conceptual model is suitable for studying the research context. The study and analysis of the model was made particularly to fit in the SSOs. As a result, it was obvious from the empirical data that factors have influenced the decision making process for ERP adoption and implementation in the two case studies. AHP technique essentially facilitates the decision-makers in articulating their specific preferences. AHP technique is an adaptable decision-making technique that support in prioritising the importance of factors influencing ERP adoption and implementation in SSOs. However, the modification of the conceptual model is detailed in Chapter Six.

6

Chapter Six: Revised ERP Adoption and Implementation Model for SSOs

6.1 Introduction

In the previous chapter, the author investigated the research propositions identified in Chapters Tow and Three. These research propositions dealt with: *(a)* factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* ERP adoption and implementation lifecycle phases and stages, and (d) mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages. Thus, Chapter Five examined and illustrated two case studies conducted in the context of KSA service sector region. The empirical findings suggested the need for modifications to the conceptual model proposed in Figure 3.5. In this chapter, the author revises the conceptual model based on the empirical findings. The author asserts that this research work satisfies the aim and objectives of this thesis and this is achieved by offering decision-makers, researchers and practitioners a model for ERP adoption and implementation in SSOs.

6.1.1 Chapter Objectives

This chapter aims to propose the revised conceptual ERP adoption and implementation model for SSOs, based on revised influential ERP adoption and implementation factors and ERP adoption and implementation lifecycle stages. To achieve the aim of this chapter, the author discusses in detail the findings extrapolated from the case studies based on factors, prioritisation, lifecycle stages and mapping of factors.

6.1.2 Chapter Structure

Initially, section 6.2 delineates the current research – that describes what has all been achieved from chapters One to Two. Thereafter, in Section 6.3 the author exemplifies the revised model for ERP adoption and implementation (i.e. including Sections 6.3.1, 6.3.1.1, 6.3.2, 6.3.2.1 and 6.3.3) is based on the revised ERP adoption and implementation factors, revised ERP lifecycle phases and stages and proposed ERP adoption and implementation model. Finally, Section 6.4 concludes this chapter that leads to Chapter Seven, which presents the overall conclusions of this thesis.

6.2 Delineating the Current Research

In Chapter One, the author presented the need and significance of investigating ERP adoption and implementation in the context of service sector. Chapter Two focuses on developing a better understanding on ERP in SSOs based on the review of the literature on ERP adoption and implementation (in general and specific to SSOs). For this reason, the main research issues derived from the research work presented in Chapter Two are: *(a)* the conjectural models that explain ERP adoption and implementation in SSOs are inadequate therefore, a comparative gap exists for examining ERP adoption and implementation in SSOs, *(b)* existing ERP adoption and implementation models and frameworks do not consider prioritising the factors and *(c)* existing ERP adoption and implementation models do not consider mapping factors on different stages of the adoption and implementation lifecycle.

In covering the research propositions, the author in Chapter Three proposed a conceptual model for ERP adoption and implementation in SSOs (Figure 3.5). The prime research propositions presented in Chapter Three for further investigation are: *(a)* factors influencing the decision-making process for ERP adoption and implementation in SSOs, *(b)* prioritising the factors based on their importance can influence ERP adoption and implementation in SSOs, *(c)* ERP adoption and implementation phases and stages, and *(d)* ERP adoption and implementation factors can be mapped on different lifecycle stages in supporting and the decision makers whilst adopting and implementing ERP systems. Having presented the conceptual model in Chapter Three, in Chapter Four the author justified the selection of a suitable research methodology. The author employed a qualitative case study based research to test the conceptual model. The author utilised this research methodology in Chapter Five to test the conceptual model. In Chapter Five, the author presented two case studies that offered much empirical data (in Sections 5.2 and 5.3). The empirical data derived from this chapter is used in Chapter Six to revise the conceptual model (Figure 3.5) for ERP adoption and implementation in SSOs. Chapter Six revises the conceptual mode based on the empirical findings presented in Chapter Five.

With regards to Chapter Six, the remaining sections in this chapter offer revision to the overall research presented in this thesis. For instance, Section 6.3 presents the overall revised conceptual model for ERP adoption and implementation. In Section 6.3.1, the author commences on revising the existing factors influencing ERP adoption and implementation based on the case study findings. In Section 6.3.1.1 the author introduces new factors (e.g. related to stakeholder, technology and organisation category factors). Then in Section 6.3.2, the author revises the ERP adoption and implementation lifecycle phases and stages based on the empirical findings. This leads to discussing on the existing stages and introducing new stages (e.g. Testing and Go Live) – both discussed based on the empirical findings in Sections 6.3.2.1. Section 6.3.3, the author presents proposed revised conceptual model for ERP adoption and implementation based on the empirical research conducted in two SSO case studies in KSA. Lastly, Chapter Six concludes with the development of a novel model for ERP adoption and implementation that can be employed as a decision-making tool by SSOs during the ERP investment evaluation process. The author does not assert that the proposed model is suitable in all decision-making circumstances; nevertheless, it can determine itself as being valuable to SSOs whilst adopting and implementing ERP systems.

6.3 The Revised Model for ERP Adoption and Implementation in SSOs

In light of the empirical findings presented in Chapter Five, in this section, the author modifies the proposed conceptual model. Initially, this chapter assesses the selection of factors influencing ERP adoption and implementation, then the recommended ERP adoption and implementation lifecycle stages, and lastly, the reassessment takes an overview of the two case studies and the application of the ERP model in SSOs.

6.3.1 Revising Existing ERP Adoption and Implementation Factors based on Case Study Findings

This section revises the existing factors based on the empirical research conducted in the case studies. During the course of this research study, the author has developed a list of factors that are considered in a theoretical proposition of ERP adoption and implementation model consists of different categories, phases and lifecycle stages. The main objective of analysing these factors through prioritising and mapping is to increase ERP adoption success in the organisations which target multiple benefits of ERP implementation. The secondary data and responses from managers of the case studies reveal that in practice organisations have considered different categories, factors, phases, and stages while adopting and implementing ERP.

In case of both case studies the factors were selected for mapping wherein they were selected by five or more managers from the total of ten respondents in a stage. Two factors namely, *customisation approach* and *business and legacy systems* were discarded by both case studies as their respective ERP systems were designed based on their specific needs analyses, and existing and targeted stage of the technological infrastructure. Both case studies have targeted project champion as one of their important outcome by adopting ERP. This is possible with the help of factors such as top management commitment from board, skills and expertise from vendors and advisors and quality work and understanding from end users and other project team employees.

However, any act from stakeholders such as top managers, execution team, IT staff, vendors, advisors and users requires the dynamic capabilities which allow the organisational learning to happen, for example knowledge transfer. This knowledge transfer will not only contribute to create human capital development but it will also instil the organisation with learning culture. Hence, the author proposes to add one more critical success factor *Knowledge Transfer* which is an outcome process of stakeholders' actions.

Case studies have taken care of any change requests that occur during and after Go Live launch. Post-assessment risk management strategy can have four sub-categories: avoidance, mitigation, reduction and hedging. Such a risk management strategy will allow the case studies to avoid any potential risk, to reduce the risk and be alternatively prepared against any risk. The risk according to organisational perspective can stem from structure, culture, technology, process, change and stakeholders' reactions. Thus, new factor to be considered in this organisational perspective is *Risk Management*. Table 6.1 illustrates the new factors.

	Factors Influencing ERP	SSO_ I	SSO_ II	New Factors
Stakeholders	Top Management Commitment	✓	✓	Knowledge Transfer (KT)
	Project Champion	✓	✓	
	Execution Team	✓	✓	
	Qualified IT Staff	✓	✓	
	External Advisory Support	✓	✓	
	Vendor Partnership	✓	✓	
	Total End-User Involvement	✓	✓	
Process	Business Process Reengineering	✓	✓	–
	Customisation Approach	×	×	
	Performance Measurement and Control	✓	✓	
Technology	IT Infrastructure	✓	✓	–
	Package Requirements and Selection	✓	✓	
	System Testing	✓	✓	
	System Quality	✓	✓	
	Information Quality	✓	✓	
Organisation	Business and IT Legacy Systems	×	×	Risk Management (RM)
	Change Management	✓	✓	
	Effective Communication	✓	✓	
	Business Vision Goals and Objectives	✓	✓	
	Training and Education	✓	✓	
	Organisational Structure and Culture	✓	✓	
Project	Project Management	✓	✓	–
	Budget – Cost Parameters	✓	✓	
	Time	✓	✓	

Table 6.1: Extraction of New Factors from the Case Studies

6.3.1.1 New Factors Influencing ERP Adoption and Implementation in the Case Studies

In this section, the author discusses on the new factors identified by conducting empirical research in the case studies. These new factors are knowledge transfer and risk management.

- ***Knowledge Transfer:*** In the context of SSO_I, there are three vendors that are involved in the implementation of SAP ERP, namely Vendor_1, Vendor_2 and Vendor_3.

  - Company 1 – Vendor_1 is responsible for designing and delivering interconnected knowledge transfer, education, and training related programs to all the related workforce (those who are involved in the ERP implementation process) at SSO_I. This was achieved in order to develop the technical expertise and skills of the workforce.

  - Company 2 – Vendor_2 who is also involved in running effective knowledge transfer and awareness programs. These programs are conducted to facilitate the workforce at SSO_I, specifically to develop their internal technical expertise, knowledge and skills.

  - Company 3 – Vendor_3 is involved in planning, managing and delivering a well developed and organised knowledge transfer program to 40 staff members from SSO_I. The intention is to get these staff members to be SAP Certified Level Three professionals and to be the focal point of SSO_I's ERP Competency Centre.

The above consortium of three companies is devoted to offer a world class training and knowledge transfer program to enable SSO_I to effectively and efficiently acquire and develop the essential competencies, knowledge and skills to deploy, operate, support and maintain the overall ERP solution optimally.

With regards to SSO_II, Vendor_A is responsible for providing support to their associate business partners on daily use of the system. Vendor_A has a dedicated on site support team that is available and can assist them in any problems raised related to the system. The support team is responsible to investigate the problem and identify a suitable solution for it. In case if Vendor_A is not permitted access to the production system, then the following will apply:

- Vendor_A will be responsible for handling all the essential paper work;

- Vendor_A will be responsible for testing the functioning of the system (this also includes the configuration of the proposed changes required in the test system, inscribing all essential scripts required for the testing, and supporting the users with the testing phase and eventually obtaining the final approval for committing the changes;

- The business users are responsible for adding all the required data to the system after the system is in the Go Live stage;

- Setting up the overall system is the responsibility of a designated support group. This setup needs to be done once all agreeable testing is performed and approved by the users; and lastly,

- All the required system customisations and patches are to be applied by the BSS DS. This is conducted once a thorough inspection is done and documented by Vendor_A.

Vendor_A is responsible for updating BSS DS with all most important supporting problems whilst the support stage. This is achieved to facilitate and sustain appropriate knowledge transfer to the BSS DS experts who eventually are responsible for supporting the overall system functioning once the Vendor_A leaves the organisation at the end of the project.

- ***Risk Management:*** In the context of SSO_I, risk management is considered highly important. Based on the knowledge acquired from the interview sessions and documentation, it was noted that project be of any nature and kind, it always has risks that are uncertain and these risks can at times cause the project to diverge from the originally set plan. Thus, risk in an IT or IS implementation project cannot be entirely excluded. Therefore, it is vital to manage risks in order to reduce the impact of unintended confrontations during the project. This can be achieved by addressing the core possible risks before any negative consequences follow. According to the interview sessions and the documentation provided, the team allocated to handle the project risks for SSO_I was asked by the management to greatly benefit from the knowledge and expertise of the consultants and project managers who successfully implemented ERP projects in the past. The management at SSO_I perceived that the knowledge gained from these consultants and project managers is very constructive and valuable in the initial exploration of problems. Moreover, according to the official documentation provided, an in progress risk management process should be formally embarked on – this is in accordance with a thorough work planning process, the steering group process, and more importantly, periodically examining and when required updating accordingly.

In the context of SSO_II, it was reported that assessment of project risk is a vital task that is required to be perform whilst the project is being defined and developed. It was also reported that potential risks are always discussed by involving all the key stakeholders and within this meetings; risks are assigned with different levels. The risk level is considered is either marked with high, medium or low level – each relying on the rigorousness of influence and the possibility of the event taking place. Then the management develops a response plan specifically for each high-level risk to make sure that the risk is handled successfully. This overall plan to ought to administer the risk, individuals designated, finishing point and the recurring dates for future examining the progress. At SSO_II, there are five prime responses to a specific risk – level it, examine it, keep away from it, move it to an intermediary or ease it. The project manager at SSO_II is required to examine the risk plans over and over again throughout the project life in accordance with their existing situation. The latter discussions on risk management at SSO_II indicate the significance of managing the risk at the initial level.

Figure 6.1 illustrates the revised factors influencing ERP adoption and implementation in SSOs and categorises the factors into: *(a)* stakeholder, *(b)* process, *(c)* technology, *(d)* organisational, and *(e)* project factors. Factors in dotted lines are new factors.

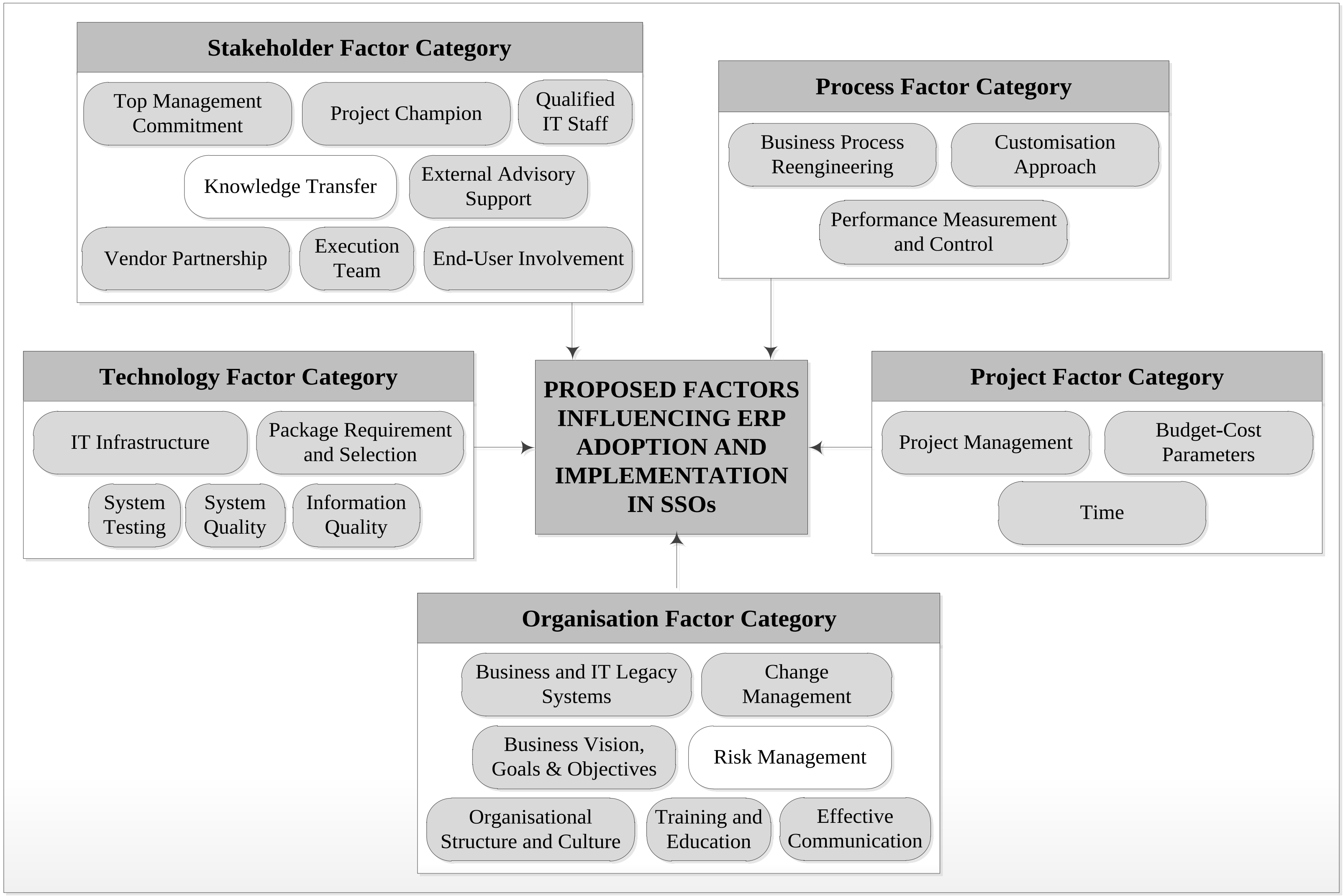

Figure 6.1: Revised Factors for ERP Adoption and Implementation in SSOs

6.3.2 Revising Existing ERP Lifecycle Phases and Stages

The author proposed three phases for ERP adoption and implementation: pre-implementation, implementation and post-implementation in this thesis. The aim of structuring activities in three phases is to make distinction between project start up and actual launch with planning of required resources and review mechanisms. Also, the macro view of the lifecycle phases allow organisations to respond the dynamic changes happening in the industry. Findings from the SSO_I illustrate that they have followed the approach similar to the ERP literature and the proposed model by dividing the activities into three phases and six stages. SSO_I has not introduced any innovative business tools in this regard. On the contrary, SSO_II has divided the whole implementation process into ten steps and two phases: plan the work and work the plan. Hence, no new lifecycle phase has been identified by either of the case study within the secondary data or primary data responses from their managers.

In the previous section, the author has explained the meaning of macro or external view of the ERP lifecycle phases which was applied unchanged by SSO_I and shortened by SSO_II. These stages form the bases for an internal micro view of the activities carried out by managers to implement the ERP. Both case studies have similar view of implementing the ERP as their highest priorities are operational efficiency, financial returns and human capital development. The six stages are assessed for the case studys' activities as follows.

- **Initiation:** This is the crucial stage for any organisation while implementing ERP as it comprises of need analysis, capital project appraisal, top management approvals for budgetary, resource allocation and addressing the employee resistance for new ERP adoption. This stage is the decider for project team and suppliers' selection. Stakeholders included in this stage are from the top hierarchy e.g. top management, IT – HR and other functional heads, team of potential suppliers and consultants advising for the ERP specifications, package and suppliers' selection (Esteves and Pastor, 1999; Markus and Tanis, 2000).

  SSO_I had given the importance to need analysis, resources availability and top management support in this stage. SSO_I considered this stage into pre-implementation phase dividing the phase into planning, creation of sub-plans and preparing statement of work agreement with vendor consortia. Intricacies faced by case SSO_I in this stage according to the feedback from their managers are difficulty in accommodating changes in the design infused by changes in the business process or market demand, end users which are not fully trained and their high initial resistance for the ERP introduction. SSO_II attempted to remove the pre-ERP limitations and to create infrastructure ready as the first activity in the initiation stage. Their next activity was to lay down the Ten Step project process to be followed as an overarching process for the whole duration of the ERP adoption and implementation. Other activities of the case SSO_II were need analysis, steering committee (top management) approvals, contracts development and vendors' short listing.

- **Adoption:** This is a bridging state between decision to adopt the ERP in the initiation stage and the actual roll out in the next implementation stage. This can also be called an acquisition or approach stage as ERP is delivered on site for implementation by supplier and the strategy for how to implement the ERP such as a big bang or in phases is decided in this stage (Ross and Vitale 2000; Al-Mashari *et al.*, (2006).

  SSO_I closely followed this and considered this duration in the implementation process as a project blueprint stage wherein activities included scope verification, service level agreements and all resources allocation approved for all the next stages. SSO_II did specifications development, blueprint design and project team selection during the adoption stage. The two most important goals in this stage for the SSO_II were top management support for the resource allocation and alignment of business strategy. Both organisations followed anticipated set of activities according to the literature with negligible modifications by naming the activities and this stage differently.

- **Implementation:** This stage brings real time issues to fore as end users directly dealt with the ERP and start making its use in the business process. Once the employee resistance and initial workability problems are solved in this stage, it is for the organisation to replicate implementation across the board. Parr and Shanks (2000) divided this stage into five major activities: installation, configuration and testing, design, reengineer and set up. Reactions stemming from this stage are dealt separately as shakedown stage to make the overall usage of the ERP normal and more closely aligned with business process, organisational culture and hierarchy and corporate vision. Problem solving, change management and conflicts resolution are crucial in this stage because absence of these tools will make the ERP non-utilised further when management and project team cannot resolve these issues in the shakedown (Rajagopal, 2002; Al-Mashari *et al.,* 2006). Implementation and shakedown stages do not bring sudden positive changes or benefits realisation; however, it keeps the organisation at the first iteration of the evolution cycle which runs through organisation till any major change happens. This stage helps to increase the ease of use and user acceptance level leading to returns on the investments (Basoglu *et al.,* 2007). This also allows top management to exert the leadership, control and business intelligence guidelines easily (Sethi *et al.,* 2008).

Both case studies followed a different approach in the implementation phase as compared to the proposed concept by the author and divided their activities into three stages of implementation, testing and Go Live. Thus, giving the implementation phase and stage the highest importance, the case studies concentrated on mitigating every risk stemming from employee training, employee resistance, system maintenance or infrastructural issues. SSO_I comprised activities of project blueprint finalisation and implementation, monitoring and controlling the implementation. To avoid any pitfalls and to thwart risk within this stage, SSO_I adopted functional tools such as ASAP methodology, Advanced Help Desk (AHD) and Inter Project Manager (IPM) all provided the main ERP supplier SAP in the project. On the other hand, SSO_II had a ‘TenStep’ project management process whilst dividing each functional module implementation into six sub-stages of start up, design, SQT, PAT, migration to production and handover support. Implementation stage mainly comprised in this case to SQT and PAT. Go Live, change requests and conflicts management were part of the shakedown stage for the SSO_II. These activities categorisation into different stages for both organisations reveal that they did not follow the proposed concept and utilise the implementation phase as three stages of implementation, testing and Go Live.

- **Shakedown:** Less reactions from the implementation stage in terms of change requests, organisational inertia, employee training and system maintenance requirements will allow the managers and the ERP to do the actual work needed to be carried out in the shakedown stage in favour of the organisation. This is part of an implementation phase in the overall lifecycle of the ERP, wherein post-roll out activities have become important as they allow the full evolution cycle to run through. That is where shakedown stage becomes an important stage in the implementation as it facilitates the streamlining of both the ERP and business process leading to further strengthening of the organisation main business and routine usage of the ERP (Markus and Tanis, 2000; Rajagopal, 2002). This is the stage which stands firmly between the failure and success of ERP implementation, since ERP system in itself and its implementation are exposed to technical, stakeholders, infrastructure, operational and business risks. Researchers suggest that shorter the period to mitigate risks and changes, easier the transition of normal operations (Markus and Tanis, 2000; Rajagopal, 2002; Al-Mashari *et al.*, 2006).

SSO_I and SSO_II have still to date not finished installing all ERP modules. Moreover, both the case studies have also not yet installed current ERP versions in all their functions, which confirm that these organisations can be considered in the post-implementation phase but their actual implementation phase is shakedown. These organisations have to carry out post-implementation phase activities for partial implementation done and post-Go Live support and stabilisation activities because they are still in shakedown stage. SSO_I had difficulties with main supplier after three years of implementation process in the last phase of ERP MRO module and terminated the contract with main vendor. There are no measurement plans in place at corporate level whereas plans were made initially in the blue print for post-implementation performance measurement as functional level.

SSO_II included activities such as Go Live, change requests raised and conflicts management in this stage since and they have not planned any other activity post-implementation except support from project team to end users. There was no control mechanism applied for growth and performance monitoring in the post-implementation stages. As an exception, supplier installed model AIM was utilised. Profit protection points were established to control the costs and expenses during and after the implementation.

- **Evolution:** Many other titles are given to this stage such as post-implementation, onward and upward, continuous improvement and enhancement. Major activities during the stage are enhancing the normal operation and installing the monitoring and control mechanism which can produce necessary information for corrective actions and management decision making. This shall allow the measurement of the realisation of the benefits as well. This stage supports the activities such as integration of more capabilities, advanced planning and stakeholders' collaboration to induce the normality in the operations and tangibility to the return on the investments made (Esteves and Pastor, 1999). Reduced budget for making changes, training and assessments can lead to further downfall in the usage of the new ERP implemented by employees at all levels (Musaji, 2005).

- **Optimisation:** Continual monitoring of business process outcomes and ERP based operations in alignment with corporate strategy would allow the project team to assess whether the benefits targeted as a result of the ERP implementation are achieved or not. This activity would allow the top management and project team to further optimise the activities in terms of input – resources and downtime and output – stakeholders' satisfaction and business performance.

The last two implementation stages, evolution and optimisation are assessed together for both case studies because of the various reasons as follows:

- Case studies have not yet implemented all the modules of the ERP.

- Case studies have not yet implemented ERP across all departments and functions in their respective organisations.

- Monitoring and control mechanisms are not yet completely deployed and realised.

- SSO_I has only one post-implementation function introduced that is project support for any short and long term change requests from end users.

- SSO_II has not reported any activities in the post-implementation stage except support function in 'TenStep' project process for the ERP.

Hence, one can infer that evolution and optimisation stages are absent in the both case studies which is evident from their secondary and primary data. The following Table 6.7 displays the above mentioned discussion about proposed phases and stages and what case studies followed in the real time practice while adopting and implementing the ERP.

Proposed Conceptual Model		Model followed by SSO_I		Model followed by SSO_II	
Lifecycle Phases	**Adoption and Implementation Stages**	**Lifecycle Phases**	**Adoption and Implementation Stages**	**Lifecycle Phases**	**Adoption and Implementation Stages**
Pre-Implementation	Initiation Adoption	Pre-Implementation	Initialisation Blueprint	Plan The Work	Initialisation Need analysis Development of Specification
Implementation	Implementation Shakedown	Implementation	Realisation Testing Go Live	Work The Plan	Implementation Testing Go Live
Post-Implementation	Evolution Optimisation	Post-Implementation	Support	N/A	N/A

Table 6.1: Revisited ERP Lifecycle Phases and Stages

As seen in the table and discussion above, both case studies have concentrated more in the implementation phase and less importance is given to post-implementation. However, considering the complexities of the project and number of activities during the implementation phase, it is advisable to have implementation phase further divided into implementation, Testing and Go Live stages whilst retaining the shakedown stage. Hence, modified concept of implementation phases will comprise of total eight stages: Initiation, Adoption, Implementation, Testing, Shakedown, Go Live, Evolution and Optimisation. This is displayed in the revised conceptual model.

6.3.2.1 New ERP Adoption and Implementation Lifecycle Stages

Herein, the author discusses on the new ERP adoption and implementation lifecycle stages extrapolated from the case study findings.

- **Testing:** During the interview sessions at SSO_I, there was a mutual consensus among all the interviewees that after the development of the required functionality of the system, the system should pass through a thorough testing process in order to ensure the overall proper functioning of the system as anticipated and as initially categorised in the design documentation. As part of the empirical findings, the author considers 'testing' another new stage along with the others proposed initially. According to the interviewees, the testing process is vital because it will help in identifying inaccuracies and fixing these errors before the system is actually handed over to the SSO_I for its proper live operation. Also as part of this testing process, a detailed testing programme was proposed that included the following types of testing, such as:

- Unit testing,
- Baseline testing,
- System testing,
- Dry run data conversion testing,
- Integration testing,
- Regression testing,
- User acceptance testing,
- Performance testing, and
- Security testing.

In the context of SSO_II, the testing stage was decided to be determined by focusing on the System Qualification Test (SQT) and Preliminary Acceptance Test (PAT) stage. For example, SQT is a core test, whereas, PAT is an end-to-end test. In the context of SQT, covers the first formal test of the solution. The testing focuses on system configuration but may include some of the customisations and data conversion. In this regard, Vendor_A were responsible for the following:

- Provide BSS with advance notice of the SQT,

- Complete, issue, and get approval for a test plan outlining the content of SQT – refer to separate deliverable: BSS DS Test Plan,

- Involve BSS in SQT, and

- Provide all required documentation (Solution Deliverables, Test Plans).

In the context of PAT, PAT is a full acceptance test of the solution. PAT must include every component of the solution the Vendor_A intends to move to production. This includes hardware configuration, customisation, and all data conversion. The PAT environment should be an exact copy of Production.

- **Go Live:** In the context of SSO_I, Go Live was reported as another stage (a final preparation stage to move on to Go Live) to those proposed in this research. Herein in this case study organisation, the intent of this stage was to conclude the overall final preparations for handing over the newly developed system to SSO_I. In doing so, there were five steps followed such as:

    - Data migration cut-over testing,
    - User training,
    - System management,
    - Cut-over activities, and finally
    - Cut-over.

  According to the official documentation provided, the cleansed data would be frequently uploaded into the newly developed SAP system. In this way, the officials from SSO_I can assess the overall quality of the data transferred and verifying the data relocation method. Moreover, once the system is handed over to the SSO_I team, Vendor_3 will be responsible for providing support for the initial period of 2 months and assisting when and where any Go Live issue arise. Vendor_3 also suggested to the officials at SSO_I that a complete system assessment will be conducted with the assistance of the prime staff members. This assessment not merely seeks to assess the exploitation of system improvement in order to enhance user acceptance, but will also create a proper route map delineating prospects for the in progress development and management of the developed system.

  In the context of SSO_II, Vendor_A is responsible for providing proper support for the live system once it is handed over to the team at SSO_II i.e. to BSS DS. The most vital components of the Go Live stage at SSO_II are:

    - To verify the appropriateness of the application to be presented into the production environment,

    - To test prime operational workflows,

- To analyse important reports,
- To endorse backup and reinstate methods,
- To endorse data migration to production environment,
- To integrate the testing process,
- To examine the system's customisations, and finally
- To evaluate the overall plan to be made it prepared before moving onto the Go Live stage.

The abovementioned discussion on the Go Live stage illustrates the significance of this stage for SSO_II. It is vital to assure the overall validity of the application and its effect on the current production modules prior to introducing to the Go Live production.

Figure 6.2 illustrates the revised ERP adoption and implementation lifecycle phases and stages in SSOs. New stages are illustrated in dotted lines.

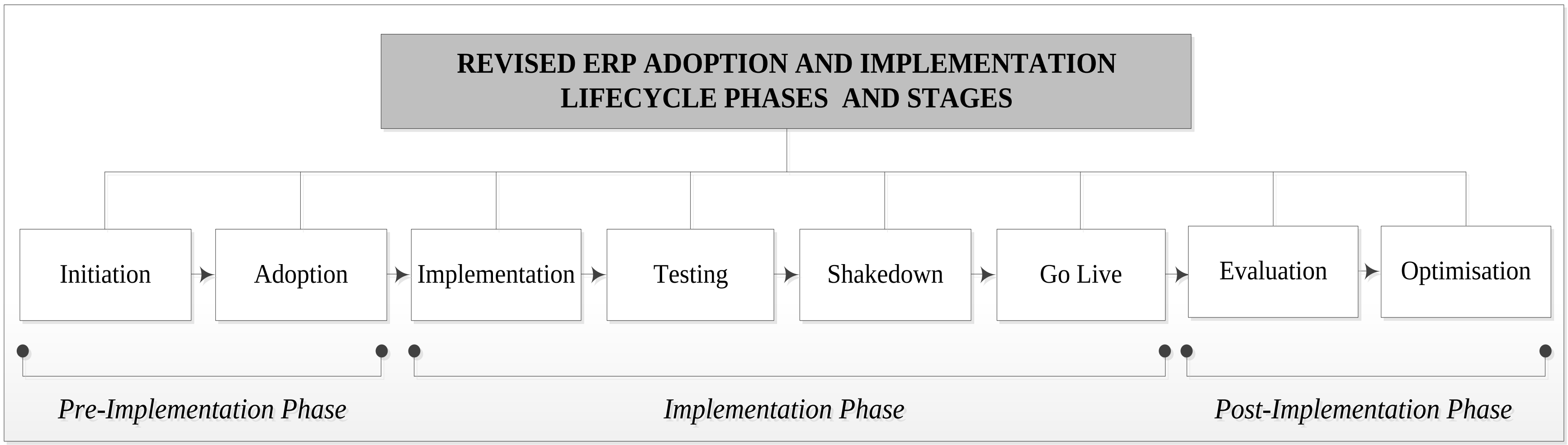

Figure 6.2: Revised ERP Adoption and Implementation Lifecycle Phases and Stages

6.3.3 Proposed Revised ERP Adoption and Implementation Model

This section finalises the theoretical proposition made in Chapter Three. This proposed theory was assessed based on the secondary and primary data from the case studies in the previous Chapter Five. Earlier sections in this chapter have provided major results for influencing factors and lifecycle stages based on the case studies evidence about ERP adoption and implementation in their respective organisations. These results suggest that there is need to revise the conceptual model in favour of making it more effective for applying in ERP adoption and implementation by other organisations in the future. As described in Chapter Five, factors influencing the ERP adoption and implementation were prioritised and mapped based on the case studies' evidence. Their prioritisation and mapping combination have led the author to finalise the selection of factors as mentioned in Table 6.1. Both case studies have applied similar underlying reasoning for adopting ERP and have followed same approach in selecting and implementation strategy. They included and discarded the same factors as influencing and CSFs for the ERP. This is evident from the mapping in the Chapter Five and selection of factors in Table 6.1. The lack of internal expertise, non-conclusive lifecycles, prolonged implementations beyond budget and time and, vendor relationships getting terminated before the end of projects reveal that the need of modification of more micro stages and other crucial factors. These factors can be knowledge transfer and risk management. The emphasis on these factors and their implementation will resolve the issues pressing these organisations during the ERP adoption and implementation.

The macro view of pre-implementation, implementation and post-implementation lifecycle phases was strongly supported by case study evidence as mentioned in Chapter Five. Hence, it will not have any modifications in finalising the model. The first two modifications are added in the ERP lifecycle stages which are embedded in the micro view of the implementation. As evident from the master plans and activities priorities during the ERP adoption and implementation, both case studies have emphasized the importance of the systems testing, quality and preliminary system acceptance procedure. This leads the author to revise the implementation phase and add a stage for 'Testing' purposes. As a protective measure, both organisations have followed a phased approach of ERP implementation instead of the organisation-wide big bang approach of the implementation. Also, for the Go Live stage, change request procedures were in place as actual implementation may reveal real time complexities and issues in using ERP in the operations, business process and decision-making. Thus, another important stage added is 'Go Live' after the shakedown stage.

The empirical findings illustrate that the role of factors, prioritising the importance ERP adoption and implementation factors, adoption and implementation lifecycle stages, and mapping of factors had high importance during ERP adoption and implementation process in the case studies. Thus, the author proposes that while exploring ERP adoption and implementation in SSOs: *(a)* identification factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* identification ERP adoption and implementation lifecycle phases and stages, and (d) mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages. The revised proposed ERP adoption and implementation model (Figure 6.3) may to improve the level of analysis and support SSO decision makers when adopting and implementation ERP. The final model with highlighted modifications is illustrated in Figure 6.3.

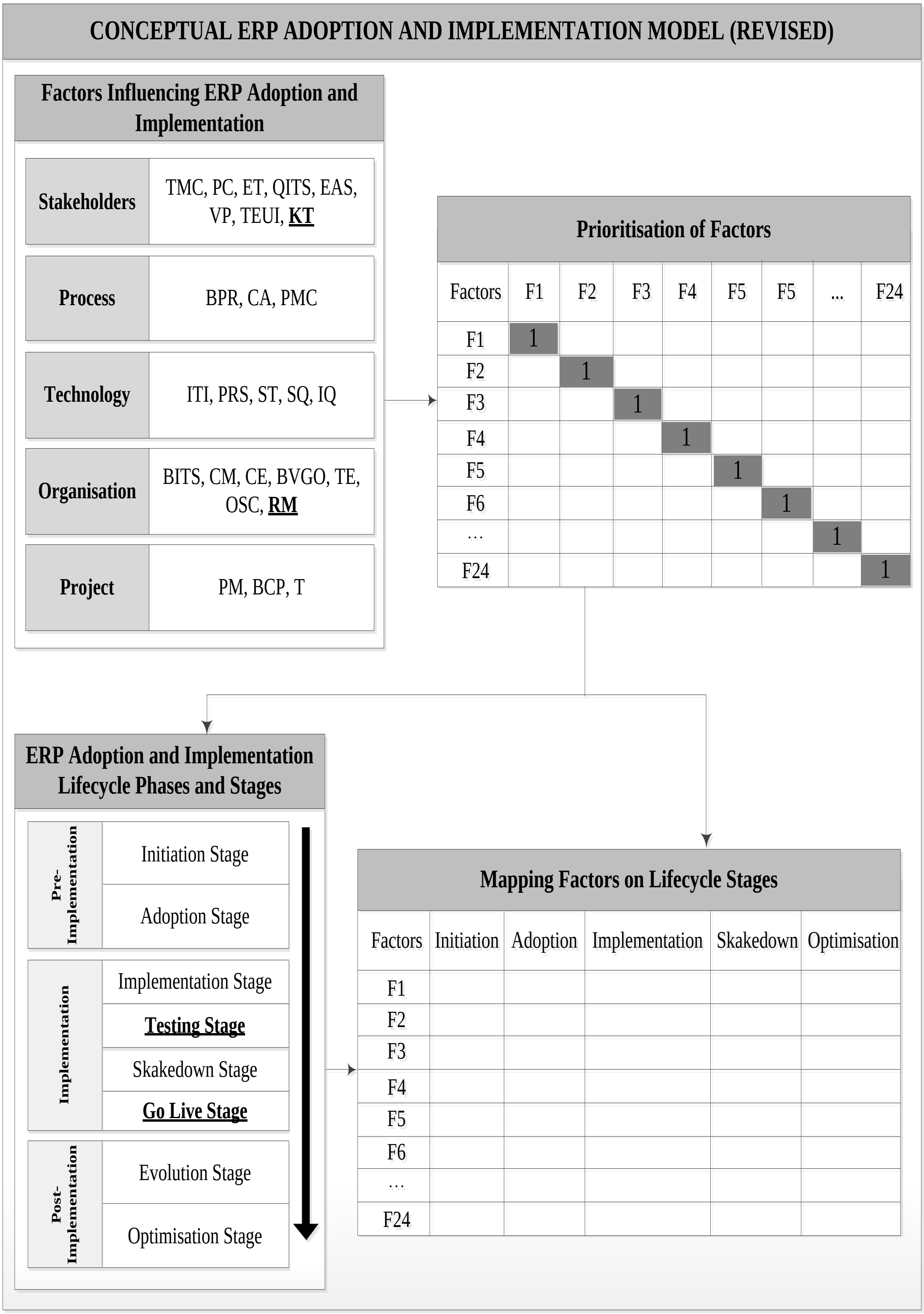

Figure 6.3: Revised ERP Adoption and Implementation Model in SSOs

6.4 Conclusion

The four dimensions *(a)* investigation factors influencing ERP adoption and implementation, *(b)* prioritising the importance of factors influencing ERP adoption and implementation, *(c)* ERP adoption and implementation lifecycle phases and stages, and *(d)* mapping of factors influencing ERP adoption and implementation on different lifecycle phases and stages and *(e)* the development of an ERP adoption and implementation model in SSOs, has been warranted and presented. This chapter proposed the revised conceptual ERP adoption and implementation model for SSOs, based on revised influential ERP adoption and implementation factors and ERP adoption and implementation lifecycle stages. The empirical findings suggested the need for modifications to the conceptual model proposed in Figure 3.5. Three new factors identified by conducting empirical research in the case studies. These new factors are knowledge transfer and risk management. In case of ERP adoption and implementation lifecycle phases and stages, both case studies have concentrated more in the implementation phase and less importance is given to post-implementation. However, considering the complexities of the project and number of activities during the implementation phase, it is advisable to add two new stages in implementation phase i.e. Testing and Go Live. Hence, modified concept of ERP adoption and implementation lifecycle stages will comprise of total eight stages: Initiation, Adoption, Implementation, Testing, Shakedown, Go Live, Evolution and Optimisation.

The ERP adoption and implementation model proposed five factor categories include: *(a)* stakeholders; *(b)* process; *(c)* technology; *(d)* organisation; and *(e)* project. Additionally, these categories have been grouped to:

- Stakeholders Factors *(top management commitment, project champion, execution team, qualified IT staff, external advisory support, vendor partnership, total end-user involvement and knowledge transfer).*

- Process Factors *(business process reengineering, customisation and approach performance measurement and control).*

- Technology Factors *(IT infrastructure, package requirements and selection, system testing, system quality and information quality).*

- Organisation Factors *(business and IT legacy systems, change management, effective communication, business vision goals and objectives, training and education, organisational structure and culture and risk management)*.

- Project Factors *(project management, budget – cost parameters and time)*.

ERP adoption and implementation factors lead to understand of the revised ERP adoption and implementation model. Therefore, these factors contribute to better decision-making during ERP adoption in SSOs. The novelty of the ERP adoption model focuses on the following:

- The model identifies several factors influencing ERP adoption and implementation. These factors are used for enterprise resource planning adoption and implementation in SSOs.

- The model prioritises importance factors influencing enterprise resource planning adoption and implementation.

- The model identifies several ERP adoption and implementation lifecycle phases and stages. Empirical findings exemplify that the case studies pass through these phases and stages while adopting ERP.

- The model maps factors influencing enterprise resource planning adoption and implementation on different lifecycle phases and stages.

- Finally, the model will assist the SSO decision makers while making the decisions for ERP adoption and implementation.

7

Chapter Seven: Research Conclusion

7.1 Introduction

In the previous chapters, the author justified the research context (as part of Chapters One and Two), proposing a conceptual model for ERP adoption and implementation in SSOs (as part of Chapter Three), justified and analysed the research methodology (as part of Chapter Four), analysed and presented empirical findings from case studies conducted in two KSA service sector organisations (as part of Chapter Five), and revised conceptual model for ERP adoption and implementation in SSOs. The latter was achieved based on revising the factors influencing ERP adoption and implementation in SSOs and ERP adoption and implementation lifecycle stages (as part of Chapter Six). This chapter aims to conclude the overall research presented in this thesis. Furthermore, to present the key contributions made by this research, to propose main limitation of this research, to highlight implications of this research and to suggest further research.

7.2 Thesis Research Overview

This thesis commenced with an introduction to the research problem in *Chapter One*. As discussed in this chapter, literature indicates that SSOs have broadly focused on employing a number of IS to automate their business processes and overcome their organisational and IT infrastructure operational problems. However, due to a number of issues in their technological infrastructure, SSOs are forced to look for better solutions that can overcome their existing IT infrastructure operational limitations. Over the past few years, ERP has significantly benefited the organisations and businesses in improving their business processes and infrastructure. Having presented the overall research context and defining the problem domain, Chapter One presents the aim of this thesis that is to *investigate enterprise resource planning adoption and implementation in the service sector organisations, resulting in the development of a model that may assist the service sector organisations in their decision making process for ERP adoption and implementation*. Thus, the objectives of this thesis are presented and lastly, Chapter One provided an overall overview of this thesis.

To achieve the overall aim and objectives of this thesis, the author in *Chapter Two* (*Background Theory*) commenced on critically reviewing the literature. In order to understand the research area in detail, the author deemed that it would be better to initially take a broader perspective of the area. In doing so, the author focussed on discussing on IT adoption and implementation in the context of SSOs. From this discussion, the author extracted the relevant research issues that resulted in limiting the seamless functionality of IT infrastructure in SSOs. Based on the IT infrastructure limitations in SSOs, the author realised the need for an integrated IS that can overcome SSO's existing IT infrastructure limitations. In highlighting the need for ERP systems, the author started by analysing ERP literature and explains the benefits realisation, and challenges. Subsequently, the author critically discussed on ERP systems adoption and implementation, discussed on factors influencing ERP adoption and implementation and discussed on ERP adoption and implementation lifecycle phases. In ending this chapter, the author justified the need for a collective and systematic approach to adopting and implementing ERP in SSOs (i.e. systematic approach focusing on factors, prioritisation of factors, ERP lifecycle phases and stages and mapping on factors) and highlighting the research issues for further investigation.

In further investigating the research issues presented in Chapter Two, the author in *Chapter Three* proposed a conceptual model for ERP adoption and implementation in SSOs. The author claims that this model in the context of SSOs and ERP discipline. Primarily, Section 3.1 offers an introduction, objectives and structure of this chapter. Thereafter, in Section 3.2 the author investigates the developing of ERP adoption and implementation model in SSOs. Herein, the author illustrates an EAI adoption model as the basis of this research. The author noted that almost all of the factors presented in Table 2.1 are extensively discussed and utilised in the literature (see Appendix B for further details on the factors). However, the author takes into consideration the key factors with most appearance frequency and further groups them into five categories (stakeholder, process, technology, organisation and project – a demonstrated in Figure 3.2) in Section 3.2.1. The author claims that these factors make a novel contribution at the conceptual level. This chapter moves onto Section 3.2.2 where the author discusses on the prioritisation of these factors. In order to do so, the author takes help of the AHP technique to conduct a pairwise comparison of these factors in order to generate their global priority weights (i.e. their importance from most to least). Then in Section 3.2.3, the author discusses on ERP adoption and implementation lifecycle phases and stages (initiation, adoption, implementation, shakedown, evaluation and optimisation) as part of Figure 3.3. The research presented to-date does not highlight any research that focuses on the mapping of the factors onto the ERP adoption and implementation lifecycle phases and stages. The author considers this a literature void. In considering this void, the author maps the factors onto the stages. This whole process was developed to enhance the overall decision-making process of SSO officials and assisting them to take their decisions appropriately with regards to ERP adoption and implementation in SSOs. In piecing together the factors, prioritisation of factors, adoption and implementation stages, and mapping of factors theory, the author proposed a conceptual model for ERP adoption and implementation in SSOs in Figure 3.5. Lastly, the research propositions are delineated in Table 3.1.

Moving onto *Chapter Four*, the author interprets and justifies the adoption and use of research approach, methodology and design to conduct the research as part of this thesis (i.e. Data Theory). By employing the opted research methodology (as diagrammatically illustrated in Figure 4.1), the author collected data and tested his proposed conceptual model in the context of SSOs within the KSA region. The essential data were extrapolated via key data collection methods such as interviews. Thereafter, the author presents *Chapter Five* (i.e. Data Theory). This chapter presents the empirical findings in detail based on two case studies conducted in two SSOs in the context of KSA region, namely SSO_I and SSO_II. *Chapter Five* commences by presenting an overall picture of the development of SSOs. Subsequently, the author moves onto presenting the preliminary research findings, gathered the relevant data from the two case studies and assessed the research propositions. In this chapter, the author applied the AHP technique (as proposed, discussed and justified in *Chapter Four*). This technique exemplified the importance of factors influencing ERP adoption and implementation in the case studies. The author asserts that this process of analysing the importance of factors enhances the quality of the overall factor assessment process. At the end of this chapter, the author conducts a brief comparative analysis of both the case study organisations in order to justify the end of empirical analysis. The author asserts that the work carried out in this chapter provided detailed insights into the direction of better comprehending the importance of factors influencing ERP adoption and implementation in SSOs.

Based on the empirical findings and analysis in *Chapter Five*, the author revised the conceptual model in *Chapter Six*. This chapter focuses on:

- Revising the proposed factors influencing ERP adoption and implementation in SSOs (as highlighted in Figure 6.1) in Section 6.3.1,

- Revising the proposed ERP adoption and implementation lifecycle phases and stages (as highlighted in Figure 6.2) in Section 6.3.2, and

- Finally, revising the conceptual ERP adoption and implementation model (as highlighted in Figure 6.3) in Section 6.3.3.

The author asserts that the empirical research findings endorsed the authenticity of the factors influencing ERP adoption and implementation, prioritising the importance of ERP adoption and implementation factors (in their specific factor categories), ERP adoption and implementation lifecycle stages and mapping of factors on ERP adoption and implementation lifecycle stages. As a result of the latter empirical research work, the author in *Chapter Six* revised the proposed model for ERP adoption and implementation in SSOs as presented in Figure 6.3. The author asserts that the proposed conceptual model in essence demonstrates a systematic way of adopting and implementing ERP systems. Thus, the decision-makers and top management can make use of this model whilst taking their decisions, as it will benefit them in comprehending the overall insights into ERP adoption and implementation. The author does not emphasize that the proposed model can be applied for any decision-making circumstance, nevertheless, it can be considered as exclusive and an effective systematic approach to conduct further research studies on ERP adoption and implementation in SSOs.

7.3 Contribution of this Research

This thesis contributes in manifold ways with each specific component of the contribution emerges from different parts of this thesis. The latter can be witnessed from the contextual information and conceptual findings in Chapters One, Two, and Three – to the justified research methodology in Chapter Four – through the assessing of conceptual findings (i.e. the proposed model) in Chapter Five – lastly, moving onto the revised conceptual model in Chapter Six. The author exemplifies (through the work carried out earlier) that this thesis has put forward an original contribution to the area of ERP adoption and implementation specifically in the context of SSOs in KSA. Moreover, this research broadens the scope and boundaries of the body of knowledge, industrial practices on ERP systems application. Thus, the author makes a case for the following contributions made without the loss of uniqueness and novelty of the work presented in this thesis.

The author asserts that this PhD thesis has contributed in the following five core areas:

- ***Contribution 1:*** Originality herein is claimed by investigating, assessing and identifying furthermore specific factors (e.g. knowledge transfer and risk management as summarised in Figure 6.1) for ERP adoption and implementation in SSOs *[herein the author fulfils research proposition 1]*.

- ***Contribution 2:*** Originality herein is claimed by prioritising the importance of factors influencing ERP adoption and implementation (in their specific factor categories) (as highlighted in Tables [5.6, 5.7 and 5.8] and [5.26, 5.27 and 5.28]) *[herein the author fulfils research proposition 2]*.

- ***Contribution 3:*** Originality herein is claimed by investigating, validating (Tables 5.11, 5.12, 5.31 and 5.32) and identifying two new ERP adoption and implementation lifecycle stages, which are embedded in the micro view of the implementation phase (Testing and Go-live stages) *[herein the author fulfils research proposition 3]*.

- ***Contribution 4:*** Originality herein is claimed by mapping ERP adoption and implementation factors on the adoption and implementation lifecycle stages (as highlighted in Tables 5.15 to 5.20 and from 5.35 to 5.40) *[herein the author fulfils research proposition 4]* and thus,

- ***Contribution 5:*** Originality herein is claimed by achieving the overall aim of this thesis i.e. overall, the abovementioned contributions lead to an original model for ERP adoption and implementation in SSOs. The author asserts that this model offers SSOs as a whole, senior management and practitioners and academics a clear guideline whilst adopting and implementing ERP.

7.4 Limitations of this Research

ERP as a discipline and technological solution, its implementation strategy and process are all well researched subjects and extensively theorised in the literature. At the same time, this richness in the literature increased the size and scale of the literature review and made the subject more complex to analyse as a phenomenon. Also, the literature review limitation was evident as there was not much literature available for the ERP adoption and implementation in SSOs and specifically, the KSA region. The initial theoretical proposition presented in the Chapter Three was based on the analyses of few development and model design studies theorised in the literature. There may be more research studies providing such crucial links. However, the critical research for this thesis was carried out for literature dated between 1998 and 2012. Furthermore, this research thesis on ERP adoption and implementation and its related factors stemmed from the work conducted by preceding researchers (e.g. Holland and Light, 1999; Esteves and Pastor, 1999; Markus and Tanis 2000; Al-Mashari *et al.,* 2006; Chang *et al.,* 2008; Dezdar and Sulaiman, 2009). Hence, the author asserts that this thesis is not a new theory development but it is a re-assessment of the extant theory with a new perspective to review the ERP adoption and implementation in SSOs.

Since ERP is a multi-objectives and multi-purpose system and is a concept for organisation's business process streamlining, any recommendations based on this research study will illustrate its positive impacts on usage in the industry in a longer duration as a futuristic application and not in the short term duration. This actually depends on the time taken for further research on the same stream by other researchers and adoption of the recommendations by the industry managers. Thus, the prime limitation of this research can be said to be the non-generalisation of the findings and recommendations. As advocates like Yin (2009), perceive that theoretically one can be correct or can be allowed to generalise based on the sample of just two case studies. However, it does not get sold to industry managers as a convincing product with a small sampling of two companies from two different industries with similar findings in just one country's context. The response rate (with regards to each question put forward) to the interviews was not sufficient, as they were reluctant in being open to the agenda questions. The author observed that this may be due to the lack of professional approach and relevant knowledge on ERP. Moreover, the fundamental reason for this sampling and response limitations are less availability of time and resources to cover more interviews in other organasation.

7.5 Implications of this Research

This research study has concluded in the previous chapters that it is beneficial to devise the view of phases, stages and value creation. It suggests the advantages of monitoring the impacts of critical success factors and utilization of new stages and factors over the conceptual model. The implications of this study can be identified into two segments for the industry and the academia. The practical implementation of the suggested conceptual model may increase the ERP implementation success rate. This research study in terms of new approach adopted by the author to formulate the implementation procedural guide would generate new strands of the ERP adoption and implementation theory.

The theoretical model was proposed initially and then finalized with changes in the previous chapter. The model contains the factors based on the five different adoption category s. Each factor is associated with one category and these factors influence each macro, micro and value creation phases and their embedded stages. Thus, it can be concluded that their acceptance, application and control may increase the success rate. The literature has supported different considerations of phases, stage and factors. In devising the model due care was taken to consider the reasons of why more than 70% of the current or past ERP implementation were not successful. Hence, the author has considered the historical negative and positive implications in building the theory refinement. The model presented finally in this study has covered the aspects of industry characteristics and other variants in terms of organisational structure, size and capabilities. By focusing on both, what went wrong in the earlier implementations, in the projects of case companies and critical success factors for the case studies has helped in refining the model. In addition to these analyses, prioritising and mapping have helped clear distinction between existence of factors and their overall importance in each stage.

The model proposed based on the induction process emphasize the role of macro and micro views of phases and stages and success factors in adopting the ERP for the organisation. This model provides the straight forward approach in terms of its lifecycle stages with set of main activities and factors associated with each adoption category s and growth drivers. The literature assessment shows that previous attempts of the ERP implementation by companies other than case studies were resulted in total chaos, loss of capital and other resources. The few framework suggested in the literature have not adopted the similar approach of phases and stages along with factors and category matrix. The proposed model provide the clear guidance on which factors are critical to the success of implementation process and their importance in each implementation stage and the benefit targeted based on the adoption category . Thus, it creates number of paths and controlling points for the industry manager to avoid any exceptions during the complete lifecycle of the ERP so that company can realize the benefits.

7.6 Recommendations of this Research

This research study has attempted to meet its main aim of creating a path for adoption and implementation success of ERP in the industry whilst analysing the ERP subject in detail, which has further generated more questions regarding ERP adoption and implementation. These questions or derived conclusions of this research provide the opportunity for the academics and industry to take this research further. The scope of this research can be advanced in two spheres: *firstly,* in terms of replicating the same or similar project whilst nullifying the research limitations associated in this project; and *secondly*, attempting to answer the questions raised through different setting of research. The major limitations of this project can be removed by engaging different strategy such as grounded theory, different sampling such as involving more cases, large number of respondents, increased geographical reach, or having longitudinal data sets.

The author claims that even though the empirical findings validated the proposed model, the research presented in this thesis cannot be considered as exception; consequently, this research can be further developed. Thus, based on the reflections of this research and its abovementioned limitations, it is recommended that further work could usefully be pursed as follows:

- ***Recommendation 1:*** Organisations operating in service sector may make use of the ERP if they want to stay competitive and to be pro-active in their decision-making as none of the respondents have rejected the idea of having ERP installed in their organisations.

- ***Recommendation 2:*** The case studies in mapping of their perspectives in targeting benefits from ERP were well aware that ERP can play a role of strategic management information backbone and business process streamliner. Thus, any organisation adopting the ERP shall not undermine the overall value addition and available utility of the ERP.

- ***Recommendation 3:*** The adoption and implementation of ERP was achieved by both the case studies in a phased approach across the organisation. However, they took more than the time planned for the project in their blueprints or master plans and increased delays have revoked their relationship with vendors. Hence, the author suggests that firms similar in size and stature can adopt of phased approach to avoid big bang approach disasters but they must manage their vendor relationship well to avoid re-allocation of design and installation tasks before organisation finishes the project.

- ***Recommendation 4:*** The author has prioritised and mapped the factors influencing the ERP adoption and implementation with introduction of new factors and new implementation stages as mentioned in the theoretical proposition. The recommendation in this regard is any organisation should first do the gap analysis to finalise their perspective of adopting and then utilise the relevant critical success factors to control the implementation process.

- ***Recommendation 5:*** The author suggests that organisations in the service sectors of airlines and telecom studied in this research compete on the quality of service, pricing and innovations. Thus, it is necessary for this type of organisations to stay ahead of the competitors in monitoring and further decision-making as proactive management behaviour. In doing so, organisations will require the multi-purpose systems like ERP.

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A

Appendix A: Abbreviations

Term	Definition
A	
AHP	Analytical Hierarchy Process
AHD	Advanced Help Desk
ANP	Analytical Network Process
AOME	Atos Origin Middle East
B	
BPI	Business Process Improvement
BPR	Business Process Restructuring
BPR	Business Process Reengineering
BSS	Business Support System
BI	Business Intelligence
BITS	Business and IT Legacy Systems
BSS DS	Business Systems Support – Development and Support
BVGO	Business Vision Goals and Objectives
BCP	Budget – Cost Parameters
C	
CSF	Critical Success Factor
COTS	Commercial-of-the-shelf
CA	Customisation Approach
CSD	Customer Specification Document
CM	Change Management
CISA	Computer Information System Applied
CRM	Customer Relationship Management
D	
D_IT	Director - Information Technology
D_SA	Director - Systems Applications
D_ERPS	Director - ERP Systems
D_HRS	Director - Human Resources Systems
D_LS	Director - Logistics Systems
D_FS	Director – Finance Systems
D_GS	Director General – Systems
D_GS	Director General – Systems
DMU	Decision Making Units
DEA	Data Envelopment Analysis
E	
EMEAA	Europe, Middle East, Asia and America
ECR	Electronic Change Request
ERP	Enterprise Resource Planning

EAI	Enterprise Application Integration
ET	Execution Team
EC	Expert Choice
EAS	External Advisory Support
EC	Effective Communication
F	
FORWARD	**F**ulfill, **O**ffer **R**e-invent **W**in **A**chieve **R**e-align **D**erive
FICO-I	Financial accounting & controlling
FICO-II	Financial accounting & controlling
G	
GCC	Gulf Cooperation Council
H	
HCM	Human Capital Management
HR	Human Resource
I	
IP	Internet Protocol
IQ	Information Quality
ICT	Information and Communication Technologies
IT	Information Technology
ITC	Information Technology Capabilities
ITI	Information Technology Infrastructure
ITI	IT Infrastructure
IS	Information Systems
IPM	inter project manager
DIT_HRS	IT Director - Human Resources Systems
ITD_HRPS	IT Director – HR and Payroll Systems
DIT_LS	IT Director - Logistics Systems
DIT_FS	IT Director - Financial Systems
K	
KSA	Kingdom of Saudi Arabia
M	
MRP	Material Requirement Planning
MRP II	Manufacturing Resource Planning
MRO	Maintenance, Repair and Overhaul
M & S	Maintenance and Support
O	
OSI	Overall System Integration
OSC	Organisational Structure and Culture
OC	Organisation Category
P	
PAT	Preliminary Acceptance Test
PC	Project Champion
PM	Project Manager
PM_ERP	Project Manager – ERP
PMC	Performance Measurement and Control
PRS	Package Requirements and Selection
PC	Process Category
PC	Project Category
PPM	Project Phase Model

PRINCE2	Projects IN Controlled Environments
Q	
QITS	Qualified IT Staff
R	
RBV	Resource-Based View
ROI	Return On Investment
RA	Ranking Approach
S	
SME	Small and Medium sized Enterprise
SCP	Structure – Conduct – Performance
SBU	Strategic Business Unit
SRM	Structure Repair Manual
SAP	Systems, Applications, and Products in Data Processing
SoW	Statement of Work
SSO	Service Sector Organisation
SMAR	Simple Multi-Attribute Rating
SRM	Supply Relationship Management
SCM	Supply Chain Management
SASO	Saudi Arabian Standards Organisation
TEP6	Six Telephone Expansion Project
SQT	System Qualification Test
SQ	System Quality
ST	System Testing
SC	Stakeholder Category
T	
TQM	Total Quality Management
TMC	Top Management Commitment
TEUI	Total End-User Involvement
TE	Training and Education
T	Time
TFC	Technology Factors Category
TCO	Total Cost of Ownership
V	
VP	Vendor Partnership
VP_IT	Vice President - Information Technology

B

Appendix B: ERP Critical Success Factors

Appendix B highlights the ERP critical success factors as presented in Table C.1

No	Author (s)	Year	Journal name	ERP Perspective	CSFs for ERP
1	Holland and Light	1999	IEEE Software	Implementation process	• Strategic: (1) Legacy systems (2) Business vision (3) ERP strategy (4) Top management support (5) Project schedule and plans • Tactical: (1) Client consultation (2) Personnel (3) BPC and software configuration (4) Client acceptance (5) Monitoring and feedback (6) Communication (7) Trouble shooting
2	Jarrar, Al-Mudimigh and Zairi	2000	IEEE	Business process management	(1) Top management commitment (2) business Process Re-engineering (3) IT Infrastructure (4) Change management
3	Parr and Shanks	2000	Journal of Information Technology	Project phased implementation	(1) Management support (2) Champion (3) Balanced team (4) Commitment to change (5) Vanilla ERP (6) Empowered decision makers (7) Best people full time (8) Deliverable dates (9) Definition of scope and goals
4	Nah and Lau	2001	Business Process Management	Lifecycle model	(1) ERP teamwork and composition (2) Top management support (3) Business plan and vision (4) Effective communication (5) Project management

					(6) Project champion (7) Appropriate business and legacy systems (8) Change management program and culture (9) Business process reengineering (BPR) and minimum customisation (10) Software development (11) Testing and troubleshooting (12) Monitoring (13) Evaluation of performance
5	Poon and Wagner	2001	Decision Support Systems	System success and project success	(1) Committed and informed executive sponsor (2) Operating sponsor (3) Appropriate IS staff (4) Appropriate technology (5) Management of data (6) Clear link to business objectives (7) Management of organisational resistance (8) Management of system evolution and spread (9) Evolutionary development methodology (10) Carefully defined information (11) System requirements
6	Al-Mudimigh, Zairi and Al-Mashari	2001	European Journal of Information Systems	Hierarchical integration and implementation	• Dominant Factors: (1) Top management commitment / support (2) Business case (3) Project Management (4) Change management (5) Training • Strategic Level (1) Current legacy system evaluation (2) Business vision (3) Implementation strategy (4) Hiring consultants (5) Benchmarking • Tactical Level: (1) Client consultation

					(2) Business process change (3) Software / vendor selection (4) Implementation approach • Operation Level: (1) Business process modelling (2) Configuring system (3) Final preparation (4) Going live
7	Trimmer, pumphery and Wiggins	2002	Journal of Management in Medicine	System integration	(1) Selecting the right employees (2) Employee morale (3) Top management support (4) Reengineering (5) Integration (6) Training employees (7) Implementation cost (8) Implementation time (9) ERP consultants (10) ERP vendors
8	Akkermans and Helden	2002	European Journal of Information Systems	Interdepartmental communication and collaboration	(1) Top management support (2) Project team competence (3) Interdepartmental co-operation (4) Clear goals and objectives (5) Project management (6) Interdepartmental communication (7) Management of expectations (8) Project champion (9) Vendor support (10) Careful package selection
9	Hong and Kim	2002	Information Management	Organisational fit and Implementation	• Organisational fit (1) Process fit (2) Data fit (3) User fit • Implementation contingencies

					(1) ERP adaption (2) Process adaption (3) Organisational resistance
10	Al-Mashari, Al-Mudimigh and Zairi	2003	European Journal of Operational Research	Lifecycle stages	• Setting up (1) Management and leadership (2) Visioning and planning • Implementation (1) Package selection (2) Communication (3) Process management (4) Training and education (5) Project management (6) Legacy systems management (7) Systems integration (8) System testing (9) Cultural and structural changes • Evaluation (1) Performance evaluation and management
11	Umble, Haft and Umble	2003	European Journal of Operational Research	Implementation success	(1) Clear understanding of strategic goals (2) Commitment by top management (3) Excellent project management (4) Organisational change management (5) Managing change (6) A great implementation team (7) Data accuracy (8) Extensive education and training (9) Focused performance measures (10) Multi-site issues
12	Nah, Zuckweiler and Lau	2003	International journal of Human-computer Interaction	Implementation success	(1) Appropriate business and information technology legacy systems (2) Business plan and vision (3) Business process reengineering (BPR) (4) Change management culture and program (5) Communication

					(6) ERP teamwork and composition (7) Monitoring and evaluation of performance (8) Project champion (9) Project management (10) Software development (11) Testing and troubleshooting (12) Management support
13	Somers and Nelson	2004	Information and Management	Stakeholders activities	• Key players: (1) Top management support (2) Project champion (3) Steering committee (4) Use of consultants (5) Project team (6) Vendor–customer partnership (7) Vendor tools (8) Vendor support • Key activities: (1) User training and education (2) Management of expectations (3) Careful selection of appropriate package (4) Project management (5) Degree of customisation (6) Data analysis and conversion (7) Business process reengineering (8) Defining the architecture choices (9) Dedicated resources (10) Change management (11) Clear goals and objectives (12) Education on new business processes (13) Interdepartmental communication (14) Interdepartmental cooperation
14	Loh and Koh	2004	International journal of production	Process theory	(1) Project champion (2) Project management (3) Business plan and vision

			research		(4) Top management support (5) Effective communication (6) ERP teamwork and composition (7) BPR and minimum customisation (8) Change management program and culture (9) Software development (10) Testing and troubleshooting (11) Monitoring (12) Evaluation of performance
15	Dowlatshahi	2005	Intl. Journal of production research	Strategic planning and design	(1) Cost of implementation (2) Implementation time (3) Return on Investment (ROI) (4) Employee training (5) Effective use of ERP features/ applications
16	Sun, Yazdani and Overend	2005	Int. J. Production Economics	Assessment and Planning	• Management/organisation (1) Commitment (2) Education (3) Involvement (4) Project team selection (5) Training (6) Roles (7) Responsibility • Process (1) Alignment (2) Documentation (3) Integration (4) Process redesign • Technology (1) Hardware (2) Software (3) Systems management (4) Interface

					• Data (1) Master files (2) Transactional files (3) Data structure (4) Maintenance (5) Integrity • People (1) Education (2) Training (3) Skills (4) Development (5) Knowledge management
17	Luarn, Lin and Lo	2005	Industrial Management and Data Systems	Non-enforceable enterprise mobilisation – Contextual	(1) Cooperation with a good solution VAR (2) Appropriate planning and the support of senior management (3) User participation and minimisation of any resistance to the installation of the system (4) Open communication channels (5) Enhancement of the understanding of mobilisation itself and of employee requirements (6) Effective mobilisation equipment
18	Ehie and Madsen	2005	Computers in Industry	Staged implementation process	(1) Project management principles (2) Feasibility/evaluation of ERP project (3) Human resource development (4) Process re-engineering (5) Top management support (6) Cost/budget (7) IT infrastructure (8) Consulting services
19	Verville, Bernadas and Halingten	2005	Journal of Enterprise Information Management	Critical success factors that affect the acquisition process ERP software	(1) Planned and structured process (2) Rigorous process (3) Definition of all requirements (4) Establishment of selection and evaluation criteria (5) Accurate information (6) Clear and unambiguous authority (7) Careful selection of the acquisition team members

					(8) Partnership approach (9) User participation (10) User buy-in
20	Gargeya and Brady	2005	Business Process Management Journal	Software amalgamation	(1) Worked with SAP functionality (2) Maintained scope (3) Project team (4) Management support (5) Consultants (6) Internal readiness (7) Training deal with organisational diversity (8) Planning (9) Development (10) Budgeting (11) Adequate testing
21	Kim, Lee and Gosain	2005	Business Process Management Journal	Critical Impediments	(1) Human resources and capabilities management (2) Cross-functional coordination (3) ERP software configuration and features (4) Systems development and project management (5) Change management (6) Organisational leadership
22	King and Burgesss	2006	Intl. Journal of information management	System innovation	• Development operations (1) Schedule (2) Cost (3) Quality • Supporters (1) Operational (2) Managerial (3) Strategic (4) Infrastructure • Organisation (1) Top management (2) Vendor (3) Project champion

					(4) Organisational resistance • Project organisation (1) Interdepartmental collaboration and communication (2) Clear goals (3) Project management package (4) Package selection (5) Team competence (6) Expectations mgmt (7) Process adaption
23	Nah and Delgado	2006	Journal of Computer Information Systems	Lifecycle based implementation	(1) Business plan and vision (2) Change management (3) Communication (4) ERP team composition skills and compensation project management (5) Top management support and championship (6) System analysis selection (7) Technical implementation
24	Olson and Zhao	2007	Enterprise Information Systems	CIO / Top Mgmt. Project up-gradation phases	• Assessment (1) Business vision (2) Top management support (3) Communication • Planning (1) Project management (2) Communication (3) External support • Action (1) Project management (2) User involvement (3) External support (4) Training (5) Customisation (6) Organisational culture (7) Project champion

					• Renewal (1) User involvement (2) External support (3) Communication
25	Woo	2007	Journal of manufacturing technology management	Post-implementation experience	(1) Top management (2) Project team (3) Project management (4) Process change (5) Education and training (6) Communication
26	Law and Ngai	2007 2007	Benchmarking: An international journal Information and management	IS user satisfaction and ERP adoption	(1) Senior management IT support (2) CEO-IT distance (3) Senior management (4) BPO support (5) Business process improvement (6) Process change approach (7) Strategic intent
27	Remus	2007	Business process management journal	ERP Portal project	(1) BPR and customizing (2) Organisational culture (3) Portal engineering roadmap (4) Portal strategy (5) Process and application integration (6) Project management and communication (7) Package selection (8) Top management Support (9) User acceptance (10) Vendor partnership
28	Nah, Islam and Tan	2007	Journal of Database Management	Implementation success	(1) Top management support (2) Team work and composition (3) Enterprise-wide communication (4) Project management program (5) Organisational culture
29	Ifinedo and Nahar	2007	Enterprise Information	Systems success	(1) Vendor/consultant quality (2) Systems quality

			Systems		(3) Information quality (4) Individual impact (5) Workgroup impact (6) Organisational impact
30	Garcia-Sanchez	2007	Information Technology for Development	System implementation	(1) Top mgmt. Support (2) Project management (3) Teamwork composition for the ERP project (4) Communication (5) Business process re-engineering (6) System selection (7) External consultants (8) Users training and support (9) Project champion (10) End users involvement (11) Change management plan (12) Tests and problem solution (13) Change facilitation (14) Business plan and vision
31	Kansal	2007	Contemporary management research	Inter-relation system analysis	(1) Top mgmt support (2) User training education (3) BPR and minimum customisation (4) Team competence (5) Project management (6) Organisational communication (7) Clear goals and objectives (8) Change management (9) Project management (10) Vendor support (11) User involvement and participation (12) External consultant (13) Compatibility of technology
32	Muscatello and Chen	2008	International Journal of Enterprise Information	Implementation Theoretical constructs	(1) Strategic initiatives (2) Executive commitment (3) Human resources (4) Project management

			Systems		(5) Information technology (6) Business process (7) Training (8) Project support and communication (9) Software selection (10) Support
33	Dawson and Owens	2008	International Journal of Enterprise Information Systems	Chartering phase of implementation	(1) Project champion (2) Project management (3) Business plan and vision (4) Top management support (5) ERP team and composition (6) Effective communication (7) Appropriate business and legacy systems (8) Commitment to the change (9) A vanilla ERP approach
34	Dezdar and Sulaiman	2009	Industrial management and data systems	Implementation success	• ERP Technology (1) Careful system selection (CSS) (2) Software troubleshooting (STT) (3) System quality (SYQ) • External expertise (1) Vendor support (VES) (2) Use of consultant (USC) • Project success: (1) On time (2) Within budget (3) Pre-determined goals achievement • Business success: (1) Inventory reduction (2) Time to market reduction (3) Personnel reduction • ERP user

					(1) User training and education (UTE) (2) User involvement (USI) • Organisation (1) Top management support (MSC) (2) Enterprise-wide communication (ECC) (3) Business plan and vision (BPV) (4) Organizational culture (ORC) (5) Business and IT legacy systems (BLS) • ERP project (1) Project management (PME) (2) Business process reengineering (BPR) (3) Change management program (CMP) (4) ERP team composition (TCC) (5) Project champion (PRC)
35	Francoise	2009	Business Process Management Journal	An extensive literature review on CSF	(1) Project teamwork and composition (2) Organizational culture and change management (3) Top management support (4) Business plan and long-term vision (5) BPR and customization (6) Effective communication (7) Project management (8) Software development, testing and troubleshooting (9) Monitoring and evaluation of performance (10) Project champion (11) Organizational structure (12) End-user involvement (13) Knowledge management
36	Doom, Milis Poelmans and Bloemen	2010	Journal of Enterprise Information Management	develop a view of critical success factors of ERP implementations in small and medium-sized companies	• Vision, scope, and goals: (1) Vision, strategic goals and business plan (2) Scope (3) Efficient management reporting • Culture, communication, and support:

					(1) Senior management support (2) User involvement (3) Effective change management (4) Internal communication (5) Supplier management • Infrastructure: (1) A standardised IT infrastructure (2) Suitable business and IT legacy systems • Approach: (1) A formalised project approach and methodology (2) Focus on user requirements (3) Use of external consultants (4) User training (5) Data accuracy (6) Alignment with business processes • Project management: (1) Proper project planning, phasing and follow-up (2) Proper project management (3) Good project teams
37	Upadhyay, Jahanyan and Dan	2011	Journal of Enterprise Information Management	Assess empirically the factors that are most critical in the ERP implementation process from the perspective of Indian micro, small and medium-scale enterprises (MSMEs)	(1) Top management (2) Goal and objective (3) User knowledge (4) Project champion (5) Project cost (6) Effective change management (7) Project composition (8) Project team competence (9) Project management (10) User training (11) External consultant (12) Organisational communication (13) Information flow management

					(14) Proper package selection (15) Vendor's staff knowledge (16) Minimum customisation
38	Maditinos, Chatzoudes and Tsairidis	2012	Journal of Enterprise Information Management	Examine the causal relationships between seven CSFs that belong to these three dimensions: • human inputs • ERP consulting process • Consequence	(1) Top management support (2) User support (3) Consultant support (4) Communication effectiveness (5) Conflict resolution (6) Knowledge transfer (7) ERP effective implementation

Table C.1: ERP Critical Success Factors

C

Appendix C: Interview Agenda

This interview agenda for review of Enterprise Resource Planning (ERP) adoption and implementation lifecycle factors, phases and stages is divided into 6 sections. This aims to address the following sections.

Section A: Organisation Information

Section B: State of ERP at Case Study

Section C: ERP Adoption and Implementation Factors

Section D: Prioritising of Critical Success Factors in ERP Adoption and Implementation

Section E: ERP Lifecycle Phases

Section F: ERP Lifecycle Stages

Section G: Mapping Critical Success Factors in ERP Adoption and Implementation Lifecycle Stages

Section A – Organisation Information

About Your Organisation

1. Business Line of the organisation
____
2. Type of the organisation
____
3. Organisation Name
____
4. Industry operating in
____
5. Category of the organisation
____
6. Revenue of the organisation
____
7. Profitable or not
____

About Your Role in Organisation

8. Your designation in the organisation
____
9. Are you involved in ERP directly / indirectly Yes / No
____
10. If yes for question 8 then in which role:
    - Key Decision Maker
    - Resource Allocator
    - Demand Analysis Team
    - Designer
    - Project manager
    - End user
    - Expert / Advisor
    - Other______________________________________
11. Your age group:
    - Under 25
    - 26 – 30
    - 31-40
    - 40 – 50
    - 50+
12. IT Literacy :
    - Basic
    - Intermediate
    - Programming

Section B – State of ERP at Case Study

About ERP Status of the Organisation

1. ERP implementation stage of the organisation

    - Identified but not finalised (Vendor selection stage)
    - Implementation started (Approved & Designing under process)
    - Being implemented and still halfway (so not sure)
    - Successful , but not fully implemented (phased approach)
    - Successful Full implementation (Realisation)
    - Failure and it is going through rectification process now (Sorting Problems)
    - Failure and gave up (did not work as expected)

2. How much budget is allocated for ERP first time implementation?

    ____

3. How much budget is allocated per year for maintenance / update?

    ____

4. Which vendor has supplied ERP or is selected to supply ERP for your firm?

    ____

About Pre - ERP Position of the Organisation

5. How was your organisational IT infrastructure organised *before* adopting ERP? Please could you draw the IT infrastructure in your organisation?

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    ____
    ____
    ____
    ____
    ____
    ____
    ____

6. Efforts to restructure your organisation have resulted in having incompatible systems. Have you ever come across to fix such a problem? If yes, what were the challenges involved?

7. If you have come across the need for integration of your organisation's information system or business process, Can you please describe, what was the process applied towards integration?

8. To what extent do you think, your organisation have some **limitations to be removed before adopting ERP**? Explain the relevant causes from list given below. If it does not include a limitation then please describe it as other.

- Earlier unsuccessful IT projects

- Hierarchical communication problems

- IT skills of managers and operational employees

- Raw material to Consumer – complete business process not ready

- Functional and divisional roles and operations ambiguity

- Inadequate resources like financial and human capital with infrastructure

Section C – ERP Adoption and Implementation Factors

1. What are the sources of strength in ERP implementation project of your organisation?

2. Does your organisation consider success factors impacts in ERP implementation? If yes, which are these factors? Are they documented and how are they controlled?

3. Who initiated the idea of adopting ERP in your organisation?

4. What are the infrastructural needs to integrate the ERP with rest of the organisation?

5. Please list in the following table top 5 points for each attribute for ERP implementation in your organisation.

Benefits to Organisation if ERP is successfully implemented	**Costs** generating issues in ERP adoption and implementation

Opportunities that would be generated by implementation of ERP	**Risks** associated with ERP adoption and implementation

6. Which factors do you think negatively affected the ERP adoption process?

____
____
____
____
____

7. If no, then which factors do you think positively affected the ERP adoption process?

____
____
____
____
____

8. What resource do you think is important: top management, project team, readiness to accept new technology, changes in the way you do a specific job or overall strengthening of business process? Why?

____
____
____
____
____
____

9. In your perspective, involving all direct stakeholders in ERP adoption decision and further implementation is the right choice to make ERP implementation successful. Do you agree with this and why?

____
____
____
____
____
____

10. Stakeholders' satisfaction as the main criteria for measuring success of ERP implementation is a right perspective. Is this true for your organisation and why?

11. Which type of stakeholders is more critical to ERP implementation success? Explain with reason for your choice.

    - Top management

    - Project team

    - End user employees

    - Vendors and external advisors

12. These factors are presented in the following table. Which of these factors do you think affect the ERP adoption and implementation process, while adopting ERP technology and how by using the ranking as: low (L), medium (M), high (H) scale and symbol (×) to show that there is no applicability.

	Factors Influencing ERP	Ranking
Stakeholders	Top Management Commitment	
	Project Champion	
	Execution Team	
	Qualified IT Staff	
	External Advisory Support	
	Vendor Partnership	
	Total End-User Involvement	
Process	Business Process Reengineering	
	Customisation Approach	
	Performance Measurement and Control	
Technology	IT Infrastructure	
	Package Requirements and Selection	
	System Testing	
	System Quality	
	Information Quality	
Organisation	Business and IT Legacy Systems	
	Change Management	
	Effective Communication	
	Business Vision Goals and Objectives	
	Training and Education	
	Organisational Structure and Culture	
Project	Project Management	
	Budget – Cost Parameters	
	Time	

13. Can you think of any other factors that affected you during ERP adoption and implementation process?

Section D – Prioritising Critical Success Factors in ERP Adoption and Implementation

1. In the following tables, rank the CSF factors of ERP adoption and implementation process by using the following scale.

Pair wise Comparison scale for Analytical Hierarchy Process Ranking	
Numerical Rating	**Verbal Judgements of Preferences**
1	A is equally preferred over B
2	A is equally to moderately preferred over B
3	A is moderately preferred over B
4	A is moderately to strongly preferred over B
5	A is strongly preferred over B
6	A is strongly to very strongly preferred over B
7	A is very strongly preferred over B
8	A is strongly to very extremely preferred over B
9	A is extremely preferred over B

Stakeholders Factors	Top Management Commitment	Project Champion	Execution Team	Qualified IT Staff	External Advisory Support	Vendor Partnership	Total End-User Involvement
Top Management Commitment	**1**						
Project Champion		**1**					
Execution Team			**1**				
Qualified IT Staff				**1**			
External Advisory Support					**1**		
Vendor Partnership						**1**	
Total End-User Involvement							**1**

Process Factors	Business Process Reengineering	Customisation Approach	Performance Measurement and Control
Business Process Reengineering	**1**		
Customisation Approach		**1**	
Performance Measurement and Control			**1**

Technology Factors	IT Infrastructure	Package Requirements and Selection	System Testing	System Quality	Information Quality
IT Infrastructure	**1**				
Package Requirements and Selection		**1**			
System Testing			**1**		
System Quality				**1**	
Information Quality					**1**

Organisation Factors	Business and IT Legacy Systems	Change Management	Effective Communication	Business Vision Goals and Objectives	Training and Education	Organisational Structure and Culture
Business and IT Legacy Systems	1					
Change Management		1				
Effective Communication			1			
Business Vision Goals and Objectives				1		
Training and Education					1	
Organisational Structure and Culture						1

Process Factors	Project Management	Budget – Cost Parameters	Time
Project Management	**1**		
Budget – Cost Parameters		**1**	
Time			**1**

Section E – ERP Lifecycle Phases

1. Do you think an external view of ERP implementation is lifecycle phases but internally when we deploy it is functions and activity based process?

Pre – Implementation

2. What is the plan followed in your organisation for ERP implementation? Is this plan divided into sub-plans? What are the sub categories of activities in this plan? Please, detail them.

3. Is your organisation have decided the time line of the implementation process of ERP? How long?

4. Is top management has committed to support ERP adoption? You may describe level of support and allocation of resources.

5. Have your organisation gone through ERP need analysis activities?

6. Is there a strategy for ERP implementation? If yes, is it in line with business strategy? Is documented can you comment on it? Who is the responsible for development and changes in the ERP strategy?

7. Can you rank following perspectives in 1 to 5 as a main focus of the assessment done?

Perspectives	**Assessment**
Stakeholders	
Process	
Technology	
Organisation	
Project	

Any other perspectives:

8. What should be the appropriate way of selecting ERP for an organisation? Why?
   - To match the competitors (Benchmarking perspective)
   - To match customer requirements (CRM perspective)
   - To derive competitive advantage through ERP (Benefits perspective)
   - To add value to the organisational operations, customer satisfaction or corporate image (value derivation)
   - Other

Why?

Implementation

9. Is it in your organisation, ERP development is done internally and is preferred over use of external expertise or vendors? Why?

10. If ERP has been supplied by vendor, who was the supplier and how the vendor and orgnisation has maintained the relationship throughout the implementation.

11. Please describe the procedure applied by your organisation to implement the ERP.

12. Describe the actual ERP implementation process. Main activities and control points.

13. How does ERP fit within the organisational structure? What are the functional departments participated in ERP implementation?

Post – Implementation

14. Do your organisation measures the outcome of ERP implementation on the organisational performance?

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15. Do you think measuring ERP implementation impacts and benefits enhance further decision making by top management?

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____

16. Which functional success is more important to your management as an improvement outcome of ERP implementation? Rank them 1 t0 6.
    - Operational efficiency ____
    - Market share ____
    - Financial ____
    - Competitive edge ____
    - Human Capital ____
    - Technical advantage ____

17. How does the organisation separate ERP impacts on organisational performance from other factors?

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18. How does the organisation get the end users' feedback and make any change in the implemented ERP?

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Section F – ERP Implementation Stages

1. Which stage do you think is very crucial in the whole process of selecting and using ERP for your firm?

2. What are the major problems you faced or you anticipate to face during that stage of ERP?

3. Do you deploy risk analysis or management strategy to decrease potential threats of risk?

4. If goals are not achieved as desired in the planning stage, what would be your decision and why?

5. Who are the key stakeholders of ERP implementation? Direct and directly related. How the team dynamics works?

6. Is there any specific models are implemented to control the implementation process?

7. What the profit centre sources from ERP implementation and how are they achieved?

8. What are the major causes of team conflicts and failures of the whole ERP projects?

9. Which process is given more importance during each stage and why?

10. Literature suggests that there are several lifecycle stages while implementing systems such as ERP. These Stages are presented in the following table.

Lifecycle Stages	**Define the level of importance as High/ Low/ Medium**	**Comment**
Initiation		
Adoption		
Implementation		
Shakedown		
Evolution		
Optimisation		

11. Can you think of any other Stages that you come across before taking the adoption and implementation decision while implementing ERP technological solutions?

Section G – Mapping Critical Success Factors in ERP Adoption and Implementation Lifecycle Stages

1. Horizontally, the following table illustrates the adoption and implementation lifecycle Stages and vertically the factors influencing the ERP adoption and implementation. In the following table, map which factor(s) you think affect the ERP adoption and implementation process.

		ERP Lifecycle Stages					
	Factors Influencing ERP	**Initiation**	**Adoption**	**Implementation**	**Shakedown**	**Evaluation**	**Optimisation**
Stakeholders	Top Management Commitment						
	Project Champion						
	Execution Team						
	Qualified IT Staff						
	External Advisory Support						
	Vendor Partnership						
	Total End-User Involvement						
Process	Business Process Reengineering						
	Customisation Approach						
	Performance Measurement and Control						
Technology	IT Infrastructure						
	Package Requirements and Selection						
	System Testing						
	System Quality						
	Information Quality						
Organisation	Business and IT Legacy Systems						
	Change Management						
	Effective Communication						
	Business Vision Goals and Objectives						
	Training and Education						
	Organisational Structure and Culture						
Project	Project Management						
	Budget – Cost Parameters						
	Time						

D

Appendix D: Pairwise Comparison

Appendix D demonstrates the detailed calculations for Steps 2 related to Sections 5.2.4.2 and 5.2.3.2.

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	5	3	7	5	9	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/5	1	2	3	5	6	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/3	1/2	1	3	5	7	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/7	1/3	1/3	1	4	5	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/5	1/5	1/5	1/4	1	3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/9	1/6	1/7	1/5	1/3	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/4	1/4	1/3	2	3	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	5	7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/7	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/7	1/4	1/6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	1/5	1/3	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7	5	1	5	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	3	1/5	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	4	1/2	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	1/4	1/6	1/5	2	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	2	1/5	1/4	4	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	1/2	1	1/4	1/3	4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	5	4	1	2	6	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	4	3	1/2	1	5	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	½	1/4	1/4	1/6	1/5	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	4
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	3
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/3	1

Table D.1: Individual Normalised Numerical Ranking of Factors by D_IT at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	4	1/3	5	7	5	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/4	1	1/6	1/5	3	1/2	1/7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	3	6	1	4	7	5	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/5	5	1/4	1	4	3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/7	1/3	1/7	1/4	1	1/3	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/5	2	1/5	1/3	3	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/3	7	1/3	3	4	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	9	7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/9	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/7	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/7	1/6	1/8	1/9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7	1	1/4	2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	4	1	3	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8	1/2	1/3	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	3	2	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	1/4	1/9	1/6	1/7	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	1/3	1/8	1/4	1/5	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	3	1	1/4	1/2	1/3	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	8	4	1	5	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	4	2	1/5	1	1/2	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7	5	3	1/3	2	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	3
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/3	1

Table D.2: Individual Normalised Numerical Ranking of Factors by D_SA at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	8	4	4	6	6	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/8	1	1/5	1/6	1/6	1/4	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/4	5	1	1/2	¼	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/4	6	2	1	2	3	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/6	6	4	1/2	1	2	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/6	4	1/2	1/3	½	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/3	4	1/2	1/3	¼	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	6	4	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/6	1	1/2	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	2	1	1/2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	2	2	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	2	1/2	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/4	1/4	1/9	1/7	1/9	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	1	2	1/8	1/4	1/6	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	1/2	1	1/9	1/4	1/6	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	8	9	1	4	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7	4	4	1/4	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	6	6	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	6
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	3
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/6	1/3	1

Table D.3: Individual Normalised Numerical Ranking of Factors by D_ERPS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	4	2	3	2	2	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/4	1	1/2	1/3	½	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/2	2	1	2	2	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/3	3	1/2	1	2	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	2	1/2	1/2	1	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/2	2	1/2	1/2	1	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/4	1	1/2	1/2	½	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	7	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/7	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1	1/2	1/2	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1	1/2	1/2	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	2	1	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	2	1	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	4	2	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/2	1/2	1/4	1/4	1/4	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1	1	1/2	1/2	1/2	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1	1	1/2	1/2	1/2	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	2	2	1	1	1	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	2	2	1	1	1	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	2	2	1	1	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	3
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	1
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/3	1

Table D.4: Individual Normalised Numerical Ranking of Factors by PM_ERP at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	¼	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.5: Individual Normalised Numerical Ranking of Factors by DIT_HRPS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	4	5	6	8	9	7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/4	1	3	4	7	8	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	1/3	1	2	6	8	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	1/4	1/2	1	6	5	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/8	1/7	1/6	1/6	1	3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/9	1/8	1/8	1/5	1/3	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/7	1/5	1/4	1/4	3	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	5	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	1/3	1/2	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	1/4	1/3	1/5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	4	1	3	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	3	1/3	1	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	5	2	3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/8	1/4	1/3	1/6	1/2	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8	1	5	6	2	7	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	1/5	1	2	1/3	4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/6	1/2	1	1/4	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	1/2	3	4	1	5	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/7	1/4	1/3	1/5	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	4
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	3
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/3	1

Table D.6: Individual Normalised Numerical Ranking of Factors by DIT_LS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	6	3	2	5	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/6	1	3	2	5	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/3	1/3	1	1	2	1/2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/2	1/2	1	1	7	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/5	1/5	1/2	1/7	1	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/2	1/2	2	1/2	2	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/2	1	1/2	1/2	2	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	6	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/6	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	1/3	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	1/4	1/4	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	4	1	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	4	1/2	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	4	1/2	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/2	1/2	1/2	1/2	1/2	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1	2	2	2	2	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1	3	2	2	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1/3	1	1/2	1/2	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1/2	2	1	2	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1/2	2	1/2	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	2	2
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1	2
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1/2	1

Table D.7: Individual Normalised Numerical Ranking of Factors by DIT_FS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	4	5	6	7	3	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/4	1	1/3	3	4	1/4	1/5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	6	1/3	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	1/3	1/3	1	3	1/5	1/6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/7	1/4	1/6	1/3	1	1/6	1/7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/3	4	3	5	6	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/2	5	4	6	7	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	6	6	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	6	6	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/6	1/6	1	1	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/6	1/6	1	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	3	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/9	1/8	1/8	1/8	1/7	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	1	3	1	1	1	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8	1/3	1	1	1	1	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8	1	1	1	1	1	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8	1	1	1	1	1	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7	1	1	1	1	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	1/4
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	1/3
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	3	1

Table D.8: Individual Normalised Numerical Ranking of Factors by D_HRS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	2	2	2	8	5	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/2	1	2	3	7	5	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/2	1/2	1	2	6	4	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/2	1/3	1/2	1	5	4	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/8	1/7	1/6	1/5	1	2	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/5	1/5	1/4	1/4	½		1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/3	1/3	1/3	1/2	4	3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	3	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/3	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	2	2	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1	3	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1/3	1	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1/2	2	1	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1/2	2	1/2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/6	1/3	1/2	1/2	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6	1	2	2	2	4	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/2	1	1/2	1/3	3	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	2	1	2	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	3	1/2	1	3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	1/3	1/3	1/3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	2	2
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1	2
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1/2	1

Table D.9: Individual Normalised Numerical Ranking of Factors by D_LS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	6	2	3	6	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/6	1	1/2	1/2	½	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/2	2	1	2	4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/3	2	1/2	1	3	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/6	2	1/4	1/3	1	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/2	3	2	2	3	1	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/2	3	3	2	3	3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1	1/4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	1/2	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	1/2	1/2	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	2	1	2	2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	2	1/2	1	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	2	1/2	2	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/2	1/2	1/2	1/2	1/2	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1	2	2	2	2	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1	2	1/2	2	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1/2	1	1/2	2	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	2	2	1	2	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2	1/2	1/2	1/2	1/2	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	2	2
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1	2
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/2	1/2	1

Table D.10: Individual Normalised Numerical Ranking of Factors by D_FS at SSO_I

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	¼	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.11: Individual Normalised Numerical Ranking of Factors by VP_IT at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	¼	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.12: Individual Normalised Numerical Ranking of Factors by D_GS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	¼	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	¼	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	¼	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.13: Individual Normalised Numerical Ranking of Factors by D_ERPS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	¼	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.14: Individual Normalised Numerical Ranking of Factors by PM_ERP at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.15: Individual Normalised Numerical Ranking of Factors by DIT_HRS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.16: Individual Normalised Numerical Ranking of Factors by DIT_LS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.17: Individual Normalised Numerical Ranking of Factors by DIT_FS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.18: Individual Normalised Numerical Ranking of Factors by D_HRS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.19: Individual Normalised Numerical Ranking of Factors by D_LS at SSO_II

		SF							PF			TF					OF						PF*		
	Factor	TMC	PC	ET	QITS	EAS	VP	TEUI	BPR	CA	PMC	ITI	PRS	ST	SQ	IQ	BITS	CM	EC	BVG	TE	OSC	PM	BCP	T
SF	TMC	1	9	5	6	2	4	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PC	1/9	1	1/3	1/3	1/6	1/3	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ET	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	QITS	1/6	3	1/3	1	1/4	1/2	1/3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	EAS	1/2	6	5	4	1	1	5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	VP	1/4	3	3	2	1	1	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	TEUI	1/5	3	1	3	1/5	1/3	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PF	BPR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PMC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/8	1/4	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TF	ITI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	4	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	PRS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1	5	4	4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/5	1	1/4	1/2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	SQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	4	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	IQ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/4	1/4	2	1	1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OF	BITS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/5	1/3	1/9	1/3	1/3	0.000	0.000	0.000
	CM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5	1	5	1/5	4	3	0.000	0.000	0.000
	EC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/5	1	1/5	1/2	1/4	0.000	0.000	0.000
	BVG	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9	5	5	1	6	3	0.000	0.000	0.000
	TE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/4	2	1/6	1	1/3	0.000	0.000	0.000
	OSC	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1/3	4	1/3	3	1	0.000	0.000	0.000
PF*	PM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1	1/3	5
	BCP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3	1	7
	T	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1/5	1/7	1

Table D.20: Individual Normalised Numerical Ranking of Factors by D_FS at SSO_II

Appendix E: Mapping the Factors of ERP Lifecycle Stages

Appendix E highlights the mapping of factors by all ten interviewees at SSO_I and SSO_II for the Initiation, adoption, implementation, shakedown, evaluation and optimisation stages. As presented in Tables E.1 to E.12.

	Factors Influencing ERP	INTERVIEWEES AND THEIR MAPPING THE INITIATION STAGE										
		D_IT	D_SA	D_ERPS	PM_ERP	DIT_HRPS	DIT_LS	DIT_FS	D_HRS	D_LS	D_FS	Result
Stakeholders	Top Management Commitment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Project Champion	–	✓	✓	✓	–	–	–	✓	✓	✓	6/10
	Execution Team	–	✓	–	✓	–	–	–	–	✓	–	3/10
	Qualified IT Staff	–	✓	–	✓	✓	–	–	–	✓	✓	5/10
	External Advisory Support	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	9/10
	Vendor Partnership	–	✓	–	✓	–	✓	–	✓	–	–	4/10
	Total End-User Involvement	–	✓	–	✓	–	–	–	–	✓	–	3/10
Process	Business Process Reengineering	–	✓	–	–	–	✓	–	–	✓	–	3/10
	Customisation Approach	–	✓	–	–	–	✓	–	–	✓	–	3/10
	Performance Measurement and Control	–	–	✓	–	–	–	–	–	–	–	1/10
Technology	IT Infrastructure	✓	✓	✓	✓	✓	✓	✓	–	✓	–	8/10
	Package Requirements and Selection	✓	✓	✓	✓	✓	✓	–	–	–	✓	7/10
	System Testing	–	–	–	✓	–	–	–	–	✓	–	2/10
	System Quality	–	–	–	✓	–	–	–	✓	–	–	2/10
	Information Quality	–	–	–	–	–	✓	–	–	–	–	1/10
Organisation	Business and IT Legacy Systems	–	✓	–	–	–	✓	–	✓	✓	–	4/10
	Change Management	–	✓	–	–	–	✓	–	✓	✓	–	4/10
	Effective Communication	–	✓	✓	✓	–	✓	–	✓	✓	✓	7/10
	Business Vision Goals and Objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Training and Education	–	✓	–	–	–	–	–	–	–	✓	2/10
	Organisational Structure and Culture	–	✓	✓	✓	–	✓	–	✓	–	✓	6/10
Project	Project Management	✓	✓	–	✓	–	✓	–	–	✓	✓	6/10
	Budget – Cost Parameters	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	9/10
	Time	–	✓	–	✓	–	–	✓	–	✓	–	4/10

Table E.1: Mapping the Factors on the Initiation Stage at SSO_I

	Factors Influencing ERP	INTERVIEWEES AND THEIR MAPPING THE ADOPTION STAGE										
		D_IT	D_SA	D_ERPS	PM_ERP	DIT_HRPS	DIT_LS	DIT_FS	D_HRS	D_LS	D_FS	Result
Stakeholders	Top Management Commitment	✓	✓	✓	✓	–	✓	✓	✓	–	–	7/10
	Project Champion	✓	–	✓	–	–	✓	–	✓	✓	✓	6/10
	Execution Team	✓	–	✓	✓	✓	–	–	–	✓	–	5/10
	Qualified IT Staff	✓	✓	✓	✓	✓	–	–	–	✓	✓	7/10
	External Advisory Support	✓	–	✓	–	–	–	–	✓	–	–	3/10
	Vendor Partnership	✓	✓	–	✓	✓	✓	–	✓	–	–	6/10
	Total End-User Involvement	–	✓	–	–	–	–	–	✓	✓	–	3/10
Process	Business Process Reengineering	✓	✓	✓	✓	✓	✓	✓	–	–	–	7/10
	Customisation Approach	–	–	–	–	–	✓	–	–	–	–	1/10
	Performance Measurement and Control	–	–	–	–	✓	–	–	–	–	–	1/10
Technology	IT Infrastructure	✓	✓	✓	✓	✓	–	✓	✓	–	–	7/10
	Package Requirements and Selection	✓	–	✓	✓	✓	✓	–	✓	–	✓	7/10
	System Testing	–	–	–	–	–	–	–	–	–	–	0/10
	System Quality	–	–	–	✓	✓	✓	–	✓	–	–	4/10
	Information Quality	–	✓	–	–	–	–	–	–	–	–	1/10
Organisation	Business and IT Legacy Systems	✓	✓	✓	–	✓	✓	–	✓	–	–	6/10
	Change Management	–	–	✓	✓	✓	✓	–	✓	✓	–	6/10
	Effective Communication	✓	✓	✓	✓	–	✓	–	✓	✓	✓	8/10
	Business Vision Goals and Objectives	✓	–	–	✓	✓	✓	✓	✓	–	✓	7/10
	Training and Education	✓	✓	–	✓	–	✓	–	–	–	✓	5/10
	Organisational Structure and Culture	✓	–	✓	✓	✓	–	✓	✓	–	✓	7/10
Project	Project Management	✓	✓	–	✓	✓	✓	✓	–	✓	✓	8/10
	Budget – Cost Parameters	✓	✓	✓	✓	✓	–	✓	✓	–	✓	8/10
	Time	–	✓	✓	✓	✓	–	✓	–	✓	–	6/10

Table E.2: Mapping the Factors on the Adoption Stage at SSO_I

		INTERVIEWEES AND THEIR MAPPING THE IMPLEMENTATION STAGE										
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	✓	✓	✓	✓	✓	✓	✓	✓		✓	9/10
	Project Champion	✓	–	✓	✓	–	✓	✓	✓	✓	✓	8/10
	Execution Team	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Qualified IT Staff	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	External Advisory Support	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Vendor Partnership	✓	✓	✓	✓	✓		✓	✓	✓	✓	9/10
	Total End-User Involvement	✓	✓	✓	✓	–	✓	✓	✓	–	✓	8/10
Process	Business Process Reengineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Customisation Approach	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Performance Measurement and Control	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	9/10
Technology	IT Infrastructure	✓	✓	✓	✓	✓	✓	–	✓	–	✓	8/10
	Package Requirements and Selection	–	✓	–	–	–	–	✓	–	–	–	2/10
	System Testing	✓	–	✓	✓	✓	✓	✓	✓	–	✓	8/10
	System Quality	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	Information Quality	✓	–	✓	✓	✓	–	✓	✓	–	✓	7/10
Organisation	Business and IT Legacy Systems	✓	✓	✓	–	✓	✓	✓	–	✓	✓	8/10
	Change Management	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	9/10
	Effective Communication	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Business Vision Goals and Objectives	–	✓	–	–	✓	–	–	–	–	✓	3/10
	Training and Education	✓	–	✓	✓	✓	✓	✓	–	✓	✓	8/10
	Organisational Structure and Culture	✓	✓	✓	–	✓	–	–	✓		✓	6/10
Project	Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Budget – Cost Parameters	✓	✓	✓	–	–	✓	–	–	–	✓	5/10
	Time	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	9/10

Table E.3: Mapping the Factors on the Implementation Stage at SSO_I

		INTERVIEWEES AND THEIR MAPPING THE SHAKEDOWN STAGE										
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	✓	–	✓	–	✓	✓	–	✓	–	✓	6/10
	Project Champion	–	✓	–	–	✓	–	✓	✓	✓	✓	6/10
	Execution Team	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	Qualified IT Staff	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	External Advisory Support	✓	–	✓	–	–	–	–	–	–	–	2/10
	Vendor Partnership	✓	–	✓	–	✓	–	✓	✓		✓	6/10
	Total End-User Involvement	✓	✓	✓	–	✓	✓	✓	✓	✓	–	8/10
Process	Business Process Reengineering	–	–	–	–	✓	–	–	✓	–	–	2/10
	Customisation Approach	–	–	–	–	–	–	–	–	–	–	0/10
	Performance Measurement and Control	✓	–	–	✓	✓	✓	–	✓	–	✓	6/10
Technology	IT Infrastructure	–	–	–	–	✓	✓	–	✓	–	✓	4/10
	Package Requirements and Selection	–	–	–	–	–	–	–	–	–	–	0/10
	System Testing	✓		–	–	✓	–	✓	✓	–	✓	5/10
	System Quality	–	✓	–	–	✓	✓	✓	✓	–	✓	6/10
	Information Quality	✓	–	–	–	✓	–	–	✓	–	✓	4/10
Organisation	Business and IT Legacy Systems	–	–	–	–	✓	✓	–	–	–	–	2/10
	Change Management	✓	–	✓	–	✓	–	–	✓	✓	✓	6/10
	Effective Communication	✓	–	✓	✓	✓	✓	–	✓	✓	✓	8/10
	Business Vision Goals and Objectives	–	–	–	–	–	–	–	–	–	–	0/10
	Training and Education	–	✓	✓	–	✓	✓	✓	✓	–	✓	7/10
	Organisational Structure and Culture	–	–	✓	–	✓	✓	–	✓	–	–	4/10
Project	Project Management	✓	✓	–	✓	✓	–	✓	✓	✓	✓	8/10
	Budget – Cost Parameters	–	–	–	–	–	–	–	–	–	–	0/10
	Time	✓	✓	–	✓	✓	✓		✓	✓	✓	8/10

Table E.4: Mapping the Factors on the Shakedown Stage at SSO_I

		INTERVIEWEES AND THEIR MAPPING THE EVOLUTION STAGE										
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	✓	–	✓	–	–	✓	–	✓	✓	✓	6/10
	Project Champion	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	Execution Team	✓	–	✓	✓	✓	✓	–	✓	–	✓	7/10
	Qualified IT Staff	✓	–	✓	✓	✓	✓	–	✓	✓	✓	8/10
	External Advisory Support	–	✓	–	–	–	✓	✓	–	–	✓	4/10
	Vendor Partnership	✓	✓	–	–	✓	✓	–	✓	–	✓	6/10
	Total End-User Involvement	✓	✓	✓	–	✓	–	✓	✓	✓	–	7/10
Process	Business Process Reengineering	✓	–	✓	✓	–	–	–	✓	–	–	4/10
	Customisation Approach	✓	✓	✓	–	–	–	–	–	–	–	3/10
	Performance Measurement and Control	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	9/10
Technology	IT Infrastructure	✓	–	–	–	✓	✓	–	✓	–	–	4/10
	Package Requirements and Selection	–	–	–	–	–	–	–	–	–	–	0/10
	System Testing	✓	–	–	–	–	–	–	✓	✓	✓	4/10
	System Quality	✓	✓	–	–	✓	✓	–		✓	✓	6/10
	Information Quality	✓	–	–	✓	✓	–	–	–	✓	✓	5/10
Organisation	Business and IT Legacy Systems	–	–	✓	–	✓	–	–	–	–	–	2/10
	Change Management	–	–	✓	✓	✓	–	–	✓	✓	✓	6/10
	Effective Communication	✓	–	✓	✓	✓	–	–	✓	✓	✓	7/10
	Business Vision Goals and Objectives	–	–	✓	–	–	–	–	–	✓	–	2/10
	Training and Education	✓	–	✓	–	✓	–	–	✓	–	–	4/10
	Organisational Structure and Culture	–	–	✓	–	✓	–	–	✓	✓	–	4/10
Project	Project Management	✓	–	–	✓	✓	–	✓	–	✓	✓	6/10
	Budget – Cost Parameters	–	–	–	–	–	✓	–	–	–	–	1/10
	Time	–	–	–	✓	✓	–	–	✓	✓	–	4/10

Table E.5: Mapping the Factors on the Evolution Stage at SSO_I

		INTERVIEWEES AND THEIR MAPPING THE OPTIMISATION STAGE										
	Factors Influencing ERP	**D_IT**	**D_SA**	**D_ERPS**	**PM_ERP**	**DIT_HRPS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	–	✓	✓	–	–	✓	–	✓	–	–	4/10
	Project Champion	–	✓	–	✓	–	–	✓	✓	✓	✓	6/10
	Execution Team	✓	✓	–	✓	–	✓	✓	✓	✓	✓	8/10
	Qualified IT Staff	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	9/10
	External Advisory Support	–	–	✓	–	–	✓	–	–	–	–	2/10
	Vendor Partnership	✓	–	✓	–	✓	–	✓	✓	–	✓	6/10
	Total End-User Involvement	–	✓	✓	✓	✓	–	✓	✓	–	–	6/10
Process	Business Process Reengineering	✓	✓	✓	✓	✓	–	✓	✓	–	–	7/10
	Customisation Approach	✓	✓	✓	–	–	–	–	–	–	–	3/10
	Performance Measurement and Control	✓	✓	✓	✓	–	✓	–	✓	–	–	6/10
Technology	IT Infrastructure	–	–	–	–	–	–	✓	✓	–	✓	3/10
	Package Requirements and Selection	–	–	–	–	–	–	–	–	–	–	0/10
	System Testing	–	✓	–	–	–	✓	–	✓	–	–	3/10
	System Quality	✓	✓	✓	✓	–	✓	–	–	–	✓	6/10
	Information Quality	✓	✓	✓	✓	✓	–	–	✓	–	✓	7/10
Organisation	Business and IT Legacy Systems	–	–	✓	–	–	–	–	–	–	–	1/10
	Change Management	–	–	✓	✓	–	–	–	✓	✓	✓	5/10
	Effective Communication	–	–	✓	✓	–	–	–	✓	✓	✓	5/10
	Business Vision Goals and Objectives	–	✓	✓	✓	–	–	–	–	–	–	3/10
	Training and Education	✓	✓	✓	✓	✓	–	✓	✓	–	–	7/10
	Organisational Structure and Culture	–	–	✓	–	–	–	–	✓	–	–	2/10
Project	Project Management	✓	–	–	✓	✓	–	✓	–	✓	✓	6/10
	Budget – Cost Parameters	–	✓	–	✓	–	✓	–	–	–	–	3/10
	Time	–	–	–	✓	–	–	–	–	–	–	1/10

Table E.6: Mapping the Factors on the Optimisation Stage at SSO_I

	Factors Influencing ERP	VP_IT	D_GS	D_ERPS	PM_ERP	DIT_HRS	DIT_LS	DIT_FS	D_HRS	D_LS	D_FS	Result
		INTERVIEWEES AND THEIR MAPPING THE INITIATION STAGE										
Stakeholders	Top Management Commitment	✓	✓	✓	–	✓	✓	✓	–	✓	✓	8/10
	Project Champion	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Execution Team	–	–	✓	✓	–	–	–	–	✓	✓	4/10
	Qualified IT Staff	–	✓	✓	–	✓	–	–	–	–	✓	4/10
	External Advisory Support	✓	✓	✓	–	✓	✓	✓		✓	–	7/10
	Vendor Partnership	✓	✓	✓	–	✓		✓	✓	✓	–	7/10
	Total End-User Involvement	–	✓	✓	✓	–	✓	✓	✓	✓	–	7/10
Process	Business Process Reengineering	–	–	–	–	✓	✓	–	✓	✓	–	4/10
	Customisation Approach	–	✓	✓	–	–	–	–	–	✓	–	3/10
	Performance Measurement and Control	–	✓	–	–	–	–	–	–	✓	–	2/10
Technology	IT Infrastructure	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	Package Requirements and Selection	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	System Testing	–	–	–	–	–	–	–	✓	✓	–	2/10
	System Quality	–	✓	–	–	✓	✓	–	–	–	–	3/10
	Information Quality	–	✓	–	–	✓	✓		√		–	4/10
Organisation	Business and IT Legacy Systems	✓	✓	–	✓	–	✓	✓	✓	✓	–	7/10
	Change Management	–	✓	–	–	–	–	✓	–	✓	√	4/10
	Effective Communication	–	✓	✓	✓	✓	✓	✓	–	✓	–	7/10
	Business Vision Goals and Objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Training and Education	–	✓	–	✓	–	–	–	–	✓	–	3/10
	Organisational Structure and Culture	–	✓	✓	✓	✓	✓	–	✓	✓	✓	8/10
Project	Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Budget – Cost Parameters	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	9/10
	Time	✓	✓	✓	✓	✓	✓	✓	–	✓	–	8/10

Table E.7: Mapping the Factors on the Initiation Stage at SSO_II

		INTERVIEWEES AND THEIR MAPPING THE ADOPTION STAGE										
	Factors Influencing ERP	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	✓	✓	✓	✓	✓	–	–	✓	–	–	6/10
	Project Champion	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Execution Team	–	✓	✓	✓	–	–	–	–	✓	✓	5/10
	Qualified IT Staff	–	✓	✓	–	–	–	–	–	✓	✓	4/10
	External Advisory Support	–	–	✓	–	✓	–	–	–	–	–	2/10
	Vendor Partnership	✓	✓	–	–	✓	✓	✓	–	–	–	5/10
	Total End-User Involvement	–	✓	–	✓	–	✓	✓	–	✓	✓	6/10
Process	Business Process Reengineering	✓	–	–	–	✓	–	✓	–	✓	✓	5/10
	Customisation Approach	–	–	✓	–	–	–	✓	–	✓	✓	4/10
	Performance Measurement and Control	–	–	–	–	–	–	–	–	✓	✓	2/10
Technology	IT Infrastructure	–	–	✓	–	✓		✓	✓	✓	✓	6/10
	Package Requirements and Selection	–	–	–	–	✓	✓	–	✓	–	✓	4/10
	System Testing	✓	–	–	–	–	–	–	–	–	–	1/10
	System Quality		–	–	–	–	–	–	–	–	–	0/10
	Information Quality	✓	–	–	–	–	–	–	✓	–	–	2/10
Organisation	Business and IT Legacy Systems	✓	–	✓	–	–	–	–	–	–	–	2/10
	Change Management	–	✓	–	✓	–		✓	–	–	✓	4/10
	Effective Communication	✓	–	✓	✓	✓	✓	✓	–	✓		7/10
	Business Vision Goals and Objectives	✓	✓	–	✓	–	✓	–	✓	–	✓	6/10
	Training and Education	–	–	✓	–	–	✓	–	–	–	–	2/10
	Organisational Structure and Culture	–	✓	✓	✓	✓	–	–	–	✓	✓	6/10
Project	Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Budget – Cost Parameters	–	–	–	✓	–	✓	–	✓	–	–	3/10
	Time	✓	✓	✓	✓	–	✓	✓	✓	–	–	7/10

Table E.8: Mapping the Factors on the Adoption Stage at SSO_II

	Factors Influencing ERP	INTERVIEWEES AND THEIR MAPPING THE IMPLEMENTATION STAGE										
		VP_IT	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	–	✓	–	–	–	✓	–	–	✓	–	3/10
	Project Champion	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Execution Team	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/10
	Qualified IT Staff	–	✓	✓	✓	✓	✓	✓	✓	–	✓	8/10
	External Advisory Support	✓	✓	✓	✓	–	✓	–	–	–	–	5/10
	Vendor Partnership	✓	✓	–	✓	–	–	✓	–	–	✓	5/10
	Total End-User Involvement	✓	–	✓	✓	–	✓	✓	✓	✓	✓	8/10
Process	Business Process Reengineering	–	✓	✓	✓	–	–	✓	✓	–	✓	6/10
	Customisation Approach	–	✓	✓	✓	–	–	✓	–	–	✓	5/10
	Performance Measurement and Control	–	✓	✓	✓	–	–	–	✓	✓	✓	6/10
Technology	IT Infrastructure	–	✓	✓	✓	–	✓	✓	✓	–	✓	7/10
	Package Requirements and Selection	–	–	–	–	–	–	–	–	–	✓	1/10
	System Testing	✓	–	✓	✓	–	✓	✓	✓	✓	–	7/10
	System Quality	✓	–	✓	–	–	–	✓	–	✓	–	4/10
	Information Quality	–	✓	✓	✓	–	✓	✓	–	✓	✓	7/10
Organisation	Business and IT Legacy Systems	–	✓	–	–	✓	–	–	✓	–	–	3/10
	Change Management	✓	✓	–	✓	–	✓	✓	✓	–	✓	7/10
	Effective Communication	✓	✓	✓	✓	✓	✓	–	✓	–	✓	8/10
	Business Vision Goals and Objectives	–	✓	–	✓	–	–	–	–	–	–	2/10
	Training and Education	✓	–	✓	✓	–	–	–	✓	✓	–	5/10
	Organisational Structure and Culture	✓	✓	✓	✓	–	–	✓	–	✓	✓	7/10
Project	Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Budget – Cost Parameters	–	–	–	✓	–	–	–	–	–	✓	2/10
	Time	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	9/10

Table E.9: Mapping the Factors on the Implementation Stage at SSO_II

	INTERVIEWEES AND THEIR MAPPING THE SHAKEDOWN STAGE											
	Factors Influencing ERP	VP_IT	D_GS	D_ERPS	PM_ERP	DIT_HRS	DIT_LS	DIT_FS	D_HRS	D_LS	D_FS	Result
Stakeholders	Top Management Commitment	–	✓	–	✓	–	✓	–	–	–	–	3/10
	Project Champion	–	✓	✓	✓	–	✓	✓	–	–	✓	6/10
	Execution Team	–	–	✓	✓	✓	–	–	✓	✓	✓	6/10
	Qualified IT Staff	–	✓	✓	✓	✓	✓	–	✓	–	✓	7/10
	External Advisory Support	–	–	–	–	–	–	–	✓	–	✓	2/10
	Vendor Partnership	–	✓	–	–	–	–	✓	✓	–	✓	4/10
	Total End-User Involvement	✓	–	–	✓	✓	✓	✓	–	–	✓	6/10
Process	Business Process Reengineering	–	–	–	–	–	–	–	✓	–	✓	2/10
	Customisation Approach	–	–	–	✓	✓	–	–	✓	–	✓	4/10
	Performance Measurement and Control	–	–	–	✓	–	–	–	✓	–	✓	3/10
Technology	IT Infrastructure	–	✓	–	–	–	–	–	–	✓	✓	3/10
	Package Requirements and Selection	–	–	–	–	–	–	–	–	–	–	0/10
	System Testing	–	–	–	–	✓	✓	–	–	–	✓	3/10
	System Quality	✓	–	–	✓	–	–	✓	✓	–	✓	5/10
	Information Quality	✓	–	–	–	–	–	✓	–	–	✓	3/10
Organisation	Business and IT Legacy Systems	–	–	–	–	✓	–	–	–	–	✓	2/10
	Change Management	✓	–	–	–	–	✓	✓	✓	–	✓	5/10
	Effective Communication	✓	–	✓	✓	✓	✓	–	✓	✓	✓	8/10
	Business Vision Goals and Objectives	–	–	–	✓	–	–	–	–	–	–	1/10
	Training and Education	✓	–	–	–	–	–	✓	✓	–	✓	4/10
	Organisational Structure and Culture	✓	–	–	✓	–	–	–	–	–	✓	3/10
Project	Project Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Budget – Cost Parameters	–	–	–	–	–	–	–	–	–	✓	1/10
	Time	✓	✓	✓	–	–	✓	✓	–	–	✓	6/10

Table E.10: Mapping the Factors on the Shakedown Stage at SSO_II

INTERVIEWEES AND THEIR MAPPING THE EVOLUTION STAGE

	Factors Influencing ERP	VP_IT	D_GS	D_ERPS	PM_ERP	DIT_HRS	DIT_LS	DIT_FS	D_HRS	D_LS	D_FS	Result
Stakeholders	Top Management Commitment	–	✓	–	–	–	–	–	–	–	–	1/10
	Project Champion	–	✓	✓	✓	✓	–	–	✓	✓	✓	7/10
	Execution Team	–	–	✓	✓	✓	–	✓	–	✓	✓	6/10
	Qualified IT Staff	–	–	✓	✓	✓	✓	✓	–	–	✓	6/10
	External Advisory Support	–	–	–	✓	–	–	–	–	–	✓	2/10
	Vendor Partnership	–	✓	–	–	–	–	✓	✓	✓	✓	5/10
	Total End-User Involvement	✓	–	–	–	✓	✓	✓	✓	✓	✓	7/10
Process	Business Process Reengineering	–	–	–	✓	–	–	–	–	✓	✓	3/10
	Customisation Approach	–	–	–	✓	✓	✓	✓	✓	✓	✓	7/10
	Performance Measurement and Control	–	–	✓	✓	✓	✓	–	✓	✓	✓	7/10
Technology	IT Infrastructure	–	✓	✓	–	–	–	–	–	–	✓	3/10
	Package Requirements and Selection	–	–	–	–	–	–	–	–	–	–	0/10
	System Testing	–	✓	✓	–	✓	–	–	✓	–	✓	5/10
	System Quality	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10/10
	Information Quality	✓	✓	✓	–	–	✓	✓	–	✓	✓	7/10
Organisation	Business and IT Legacy Systems	–	–	–	–	–	–	–	–	–	✓	1/10
	Change Management	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	9/10
	Effective Communication	✓	–	✓	✓	✓	✓	✓	✓	–	✓	8/10
	Business Vision Goals and Objectives	✓	–	✓	✓	–	–	–	–	–	–	3/10
	Training and Education	✓	✓	–	✓	✓	✓	✓	–	✓	✓	8/10
	Organisational Structure and Culture	✓	–	–	–	–	–	✓	–	–	–	2/10
Project	Project Management	✓	✓	✓	✓	✓	–	✓	✓	✓	–	8/10
	Budget – Cost Parameters	✓	✓	–	–	–	–	–	–	–	–	2/10
	Time	✓	✓	✓	–	–	✓	✓	–	–	✓	6/10

Table E.11: Mapping the Factors on the Evolution Stage at SSO_II

		INTERVIEWEES AND THEIR MAPPING THE OPTIMISATION STAGE										
	Factors Influencing ERP	**VP_IT**	**D_GS**	**D_ERPS**	**PM_ERP**	**DIT_HRS**	**DIT_LS**	**DIT_FS**	**D_HRS**	**D_LS**	**D_FS**	**Result**
Stakeholders	Top Management Commitment	–	✓	–	–	–	–	–	–	–	✓	2/10
	Project Champion	–	–	–	–	✓	–	–	✓	–	✓	3/10
	Execution Team	–	–	✓	✓	✓		✓	–	✓	✓	6/10
	Qualified IT Staff	–	–	✓	–	–	✓	✓	✓	✓	✓	6/10
	External Advisory Support	–	–	–	–	–	–	✓	✓	✓	✓	4/10
	Vendor Partnership	✓	✓	–	✓		–	✓	✓	✓	✓	7/10
	Total End-User Involvement	✓	✓	–	–	✓	✓	✓	✓	–	✓	7/10
Process	Business Process Reengineering	–	✓	–	–	–	–	✓	✓	✓	✓	5/10
	Customisation Approach	–	✓	–	–	✓	✓	✓	✓	–	✓	6/10
	Performance Measurement and Control	✓	✓	✓	✓	✓	–	✓	✓	–	–	7/10
Technology	IT Infrastructure	–	✓	–	–	–	–	–	–	–	✓	2/10
	Package Requirements and Selection	–	✓	–	–	–	–	–	–	–	–	1/10
	System Testing	–	–	–	–	✓	–	✓	–	✓	✓	4/10
	System Quality	–	–	–	–	–	✓	✓	✓	✓	✓	5/10
	Information Quality	–	✓	✓	✓	✓	–	✓	–	✓	✓	7/10
Organisation	Business and IT Legacy Systems	–	✓	–	–	✓	–	–	–	–	✓	3/10
	Change Management	–	–	✓	–	✓	–	✓	✓	✓	✓	6/10
	Effective Communication	✓	✓	✓	✓	✓	✓		✓	–	–	7/10
	Business Vision Goals and Objectives	–	✓	–	✓	–	✓	✓	–	–	–	4/10
	Training and Education	✓	✓	–	–	✓	–	–	–	–	✓	4/10
	Organisational Structure and Culture	–	✓	–	–	–	–	✓	–	–	–	2/10
Project	Project Management	✓	✓	✓	✓	✓	–	✓	✓	✓	–	8/10
	Budget – Cost Parameters	✓	✓	–	–	–	✓	✓	–	–	–	4/10
	Time	✓	✓	✓	–	–	✓	✓	–	✓	–	6/10

Table E.12: Mapping the Factors on the Optimisation Stage at SSO_II