A New Framework for Enterprise Resource Planning Systems Implementation for SMEs in the Industrial Manufacturing Sector in Iran

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Abstract

This thesis proposes an Enterprise Resource Planning (ERP) implementation model for small to medium-sized enterprises (SMEs) in the discrete manufacturing industry sector in Iran. Three discrete manufacturing SMEs, in two different geographical locations in Iran (Isfahan and Tehran), were used as the case studies for primary qualitative research and data analysis. The proposed model identifies ERP implementation phases, three main dimensions of change and a range of related change elements that influence ERP project success in the discrete manufacturing sector in Iran. The three main dimensions of change are technology deployment, people competencies, and process improvement; and these are evident in this study's three implementation phases: pre-implementation, implementation, and post-implementation.

Being exploratory in nature and adopting an interpretivist epistemology, the research pursues a qualitative approach, consisting of a survey (with follow-up interviews), questionnaires, semi-structured interviews and documentary evidence for data collection. The case study approach allowed the researcher to gain an in depth understandings of the nature of ERP implementation in discrete manufacturing SMEs and the degree of success they have achieved. The first set of data was collected through a literature review and qualitative survey of 75 manufacturing SMEs in Iran in order to understand the extent of IS/ERP systems implementation in Iranian manufacturing SMEs. The findings from the literature were used to develop a provisional conceptual ERP implementation model. The second set of data was collected from three discrete manufacturing SMEs through questionnaires and semi-structured interviews conducted with various employees.

The conceptual ERP implementation model was further improved based on findings drawn from the case study research. The final model was developed to represent ERP implementation phases, dimensions and elements of change in the context of SMEs in the discrete manufacturing sector in Iran. The model is a contribution to knowledge in this field, and affords IT practitioners and professionals a better understanding of the potential challenges they may face during such ERP projects. The model enables them to balance the three dimensions of change, providing a roadmap of change elements that need addressing as an ERP project progresses from phase to phase.

DECLARATION

I declare that the work in this thesis has been carried out in accordance with the regulations of the University of Gloucestershire and it is original except where indicated by specific reference in the text. No part of this thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas. Any views expressed in this thesis are those of the author and in no way represent those of the university.

Signature: Date: 31/09/2016

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DEDICATION

I dedicate this research work to my entire family for their boundless support.

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Chapter 1
Introduction

1.1 Introduction

The unpredictable and rapid development of information technology (IT), combined with a high level of competition in the market, have changed the business world significantly (Nikookar *et al.,* 2009). Small to medium sized enterprises (SMEs) in Iran encountered a new kind of technology market in the last decade. Given the significant role of SMEs in the economy of a country, it is now crucial for SMEs to adopt IT to support their business in operations, management, and decision making to enhance their business performance (Thong & Yap, 1996). The success of SMEs is a major focus for many countries because of their effect on economic and social development. It is essential for SMEs to use IT applications in order to compete globally and access the global market. IT applications and enterprise resource planning (ERP) systems in particular, help SMEs to increase their return on investment by reducing costs and increasing efficiency and effectiveness (Nikookar *et al.,* 2009; Deneva & Wieringa, 2006).

Enterprise resource planning computer systems are a key element of a company's IT infrastructure. ERP is computer software, which integrates and shares internal and external information across business processes within an entire enterprise. This software encompasses processes and functions such as marketing, human resource management (HR), finance and accounting, project management, sales and customer service, manufacturing, materials management, engineering and production planning. Large companies and governmental organisations have been willing to make such a commitment and have successfully adopted and implemented ERP systems for many years to optimise business processes and support the achievement of business targets (Nikookar *et al.,* 2009). However, implementing ERP can also have negative effects on the performance of business (Hawari & Heeks, 2010), so it is important for Iranian SMEs to be careful and cautious in their IT investment decision-making.

Considering the importance of adopting ERP in Iranian SMEs successfully, this research focuses on the constraints and elements that influence ERP implementation in discrete manufacturing SMEs in Iran to propose and develop a new framework for implementing ERP. This chapter will provide an overview of the research study by investigating the research background and problems followed by the research objectives and question. Next, the study will focus on Iranian culture and the geographical situation of Iran in order to understand the environment that will affect the study followed by scope and justification of the study. Finally, an outline of the structure of the thesis will be provided.

1.2 Research Background and Problem

ERP has been applied in businesses since the early 1990s, underpinned by on-going research and development (Fathi & Mohammadi, 2012). It was one of the most significant growth areas in business information systems in the last decade of the twentieth century (Davenport, 2000). Organizations have been keen to integrate ERP systems into their current business environment due to its business productivity, efficient business process, and improved cost saving (Tilley, Bruce & Hallam, 2007). Al-Mashari (2002), and Al-Shamlan and Al-Mudimigh (2011) describe ERP implementation as the most pioneering development that replaces legacy systems with new technology and leads to significant process change within a business.

Most ERP systems have been designed and developed for large businesses based on their business processes and best practices (Snider, Silveria & Balakrishnan, 2008). The high demand for ERP systems developed by vendors such as SAP, Oracle, BaaN, PeopleSoft, JD Edwards, Microsoft Dynamic, Sage, Infor, Lawson, Epicor and so on as a solution for large enterprises, encourage ERP vendors to design and develop ERPs for SMEs as a new market, because the ERP market for large organisations has become saturated (Federici, 2009). Also, considering the significant role of SMEs in economics of all countries, ERP vendors all over the world have paid attention to supporting SMEs at all their stages of development.

Despite the fact that there is extensive adoption of ERP in SMEs in developed countries, developing countries lag a long way behind. Consequently, a developing country such as Iran can be considered as a good market for ERP vendors due to its recent economic growth. Even though adopting and implementing of ERP system is an established information systems strtaegy, there are still many organizations, especially SMEs, who are reticent about implementing such a system in their organizations (Hakim & Hakim, 2010). In developing countries such as Iran this hesitation is driven by the unfamiliarity and uncertainly of organizations with this systems, past failure in implementing ERP systems, and concern about business process change implications. Also, it has been argued by Shahawai and Idrus (2011) that adoption of such systems by most SMEs in developing countries, especially in the Islamic republic of Iran (Iran), is a relatively new activity, due to the high expense and technical complexity of such systems.

SMEs are the backbone of the global economy (Host Review, 2012). Some SMEs in developed countries have adopted IT to support their businesses and compete globally (Host review, 2012). In Iran, there have been some reports (Soltanzadeh & Khoshsirat, 2012) on ERP applications, but they have focused on ERP implementation for large companies (Asghari, Allahverdiloo & Samkhani, 2011). However, SMEs sometimes have business processes that differ somewhat from those that typify the operation of large businesses, as SMEs have very different business requirements and expectations (Koh & Simpson, 2005). Therefore, vendors need to carefully consider and accommodate SME differences and their market position (Hatala, 2010). Another issue is the complexity in selecting and implementing ERP to enhance their business performance (Haddara & Zach, 2011). Fink (1998) and Thong (1999) state that SMEs' IT adoption is different from larger businesses due to their limited resources. In addition, the process of implementing ERP in SMEs will vary from large organizations because of differences in management structures, market types, cultural differences (for example in small family businesses) as well as available resources. This implies that different approaches to implementation may be required (Snider *et al.*, 2008).

Talebi (2007) asserted that the great majority of businesses in Iran belong to the category of micro, small and medium-sized enterprises (SMEs). Ghobakhloo's study revealed that there is lack of understanding of the adoption and implementation of ERP systems in SMEs in Iran and one of the most frequently asked questions by Iranian SMEs is how to adopt and implement ERP systems successfully (Ghobakhloo *et al.*, 2011). In Iran, specifically, there has been very little research on ERP deployment. Therefore, it is necessary and very important to evaluate the current ERP application situation in SMEs in Iran and to propose and develop a new framework for selecting and implementing ERP for discrete manufacturing SMEs in Iran. Therefore, this study will be a contribution to new knowledge generation in this field.

The choice of research topic has been driven by the author's concern about the successful implementation of ERP in Iranian discrete manufacturing SMEs. The concern has been developed because of the regular failure in ERP implementation projects in Iranian organizations (Dezar and Ainin, 2010; Hakim and Hakim, 2010) and limited study in this area. Lack of knowledge, costly process, and complexity of selecting and implementing ERP systems are main issues in SMEs in developing countries (Dezar and Ainin, 2010). In Iran, as we mentioned before there is some research on ERP deployment, but most projects have concentrated on implementing ERP in large organization, identifying the failure or success factors and implementation risks, rather than developing a new framework for selecting and implementing ERP for SMEs in the discrete manufacturing sector in Iran (Hakim and Hakim, 2010).

Then again, as has been discussed before, many businesses regardless of their size have adopted and implemented ERP systems successfully in developed countries. Broadly speaking, most IT applications standards are aligned with the requirements of business in developed countries. Otieno (2008) stated that adopting ERP systems (which have been developed based on the requirements of businesses in developed countries) in developing countries, usually leads to failure related to basic infrastructure issues, culture, economy, religion, and the geographical situation of that country. Therefore, adopting such a system in developing countries, especially in SMEs, has faced many difficulties and challenges, which lead to the failure of the system. The studies of Soh and Sia (2004) also indicated that one of the key issues in ERP implementation is that ERP packages are designed based on business needs in developed countries. Thus, the implementation of these ERP packages in developing countries will cause difficulty, as this system has been developed by vendors or developers based on their available resources and knowledge and standards on their homeland to inaugurate best practice. They further argued there are misalignment issues between ERP functionality and organizational needs in developing countries as the business models embedded in ERP packages reflect developed countries' industry work practices.

The majority of research undertaken in developing countries, especially in Iran, has indicated that adopting such a system can drive a business into financial difficulties (Dezaer & Ainin, 2010; Hakim & Hakim, 2010). Monk and Wagner (2006) concluded that the ERP implementation process can consume a large proportion of a company's income over the first one to three years' duration. With regard to the majority of businesses in Iran, they belong to the category of micro, small and medium-sized enterprises. Bayati (2007) stated that the majority of SMEs in Iran are in the private sector. An overview of existing studies indicated that poor implementation processes, high costs, lack of knowledge, insufficient training, and the culture of SMEs in Iran are the main issues in Iranian SMEs' problems with IT implementation (Shahawai & Idrus, 2011). Poba (2008) stated that 66% to 70% of ERP implementation in developing countries leads to failure. Regarding the major role of SMEs in developing countries' economic growth, it is essential for SMEs to understand ERP implementation practice, in Iran in particular, as this system is still new and is likely to encounter many challenges, such as cultural challenges.

All the above shows that there is always a gap between systems designed to be generic and an individual organization's needs; in other words, embedded business model in ERP packages have implied background biases based on sector, industry, country and so on. In light of the above discussion, the main purpose of this study is to study the situation of information system (IS) and ERP market in Iran to see if it is feasible to implement an ERP system, and then propose an ERP implementation model suitable for discrete manufacturing SMEs in Iran.

1.3 Research Rationale and Framework

The major motive for undertaking this study is the lack of a comprehensive framework for ERP implementation among discrete manufacturing SMEs in Iran. Despite the development of ERP implementation, evidence shows that implementing ERP in SMEs in developing countries is not as successful as in developed countries. Secondly, even though there are many studies about ERP implementation challenges, they mostly focus on ERP implementation on developed countries or large companies. There are a few studies on this topic in developing countries, and there are not many reports regarding ERP implementation success and failure factors in SMEs in developing countries. In addition, most ERP implementation models and framework studies have been carried out in developed countries. Soh and Sia (2004) believed that majority of ERP systems are based on developed countries' business models and best practice. As a result, ERP systems do not always match the needs of local users in developing countries. Accordingly, the special situation of Iran from the political, economic, cultural point of view can lead the research to improved existing hypothetical paradigms and may constitute completely new research. As a result, the researcher would like to review existing situation of discrete manufacturing SMEs and existing ERP implementation frameworks to propose a new framework for SMEs in the discrete manufacturing sector in Iran.

The literature has highlighted significant differences between SMEs and large organizations. According to McCartan and Carson (2003), even the top management in SMEs are usually involved in daily activities of the company. Mintzberg and Gosling (2003) believed that having a small management team which leads to efficient decision making and informal structures and culture, which escalate cross-functional exchanges in SMEs, can be considered as advantages for large projects. However, as discussed earlier, lack of financial and human resources, short term planning, limited training and high cost of consultant support are the main disadvantages of SMEs which can delay the implementation process. Shin (2006) in his studies stated that SMEs are more fragile than large organizations and also they face more challenges to obtain credit. Overall, implementing technology and reengineering projects in SMEs are more difficult than in large companies, and SMEs can be harmfully affected by failed implementation.

Review of a large and growing body of ERP implementation literature illustrates that there are not many studies to have assessed these problems in SMEs in Iran and most of them only identified the CSFs and CFFs in other developing countries' SMEs. This is despite the evidence that successful ERP implementation in SMEs has been subject to a great deal of research in developing countries in general (Heeks 2002; Avgerou, 2008). According to the above mentioned, the implementation of an ERP system in SMEs is a complex process. Many researchers in developed countries like UK have proposed ERP implementation models based on the business needs in SMEs in order to deliver a successful implementation.

In this study, an implementation framework will be developed based on the literature review, and the case study findings. The research will review current ERP implementation models, which have been adopted successfully in SMEs in developed countries, ERP strategy and models. It will also consider success or failure factors related to Technology (such as legacy systems), People (employees, such as training or employee involvement), and Process (such as company's current business process) to design an implementation framework for the discrete manufacturing SMEs in Iran.

1.4 Research Objectives and Questions

1.4.1 Research Objectives

The overall aim of this research is to investigate the adoption and implementation of commonly used ERP systems in Iranian manufacturing SMEs and then to propose and develop a new framework for ERP systems adoption and implementation for SMEs in the automotive industry supply chain in Iran. In order to accomplish this overall research aim, three key objectives have been set:

1. To analyse and evaluate the current situations of IT and IS applications in general and existing ERP applications in particular in Iran.
2. To investigate and assess how ERP systems have been implemented and how successful these projects have been.
3. To analyse and evaluate how ERP systems have been implemented and to propose and develop a new framework for ERP system adoption and implementation for SMEs in Iran.

1.4.2 Research Questions

The aim of this study is to answer the following questions about the Iranian SMEs in respect to the conceptual framework identified from the literature review:

1. What is the extent of ERP systems implementation in Iranian SMEs?
2. What has been the nature of ERP implementation in Iranian SMEs? Have the change dimensions of technology deployment, process improvement and people skills enhancement been in balance? What have been the critical change elements or factors?
3. What new framework can be developed for Iranian SMEs to adopt and implement ERP systems to improve their business performance?

1.5 Overview of Culture, Religion and Geographical Situation of Iran

Iran is located in Western Asia and the Middle East. Iran’s population includes some of the most varied ethic groups in the world, comprising Persians, Azerbaijanis, Kurds, Lures, Arabs, Baluchs, Turkmens and Turkic tribes, and Armenians (Central Intelligence Agency, 2013) which leads to various cultures. Literature indicates that many researchers (e.g. Dezar & Ainin (2012; Nikookar *et al.*, 2009) are concerned about culture and believe that cultural differences affect ERP implementation. According the a study of Dezar and Ainin (2012), cultural difference leads to critical issues in ERP implementation. They mentioned ‘Uncertainty’ as one of the cultural dimensions, which affect the way organisations utilise IS. The majority of Iranian SMEs are private and family owned, so they are not confident to share information throughout the company. Most SMEs’ managers are not flexible and prefer the traditional management system and to handle their business based on experience. They believe their information is personal and they only will share information based on their own concerns. They have a tendency not to accept organisational changes, which can often occur as a result of deploying IS (Dezar & Ainin 2012).

The official language is Parsi (Persian) and official religion is Islam, which governs personal and economic lives in Iran. Iran has special geographic situation among the region because of its large reserves of fossil fuels, which include the largest natural gas supply in the world and the fourth-largest proven petroleum reserves. Considering the geographic situation of Iran, it can be a good market for SMEs to develop and compete globally by implementing Information Systems.

Various sanctions by USA and EU have affected the Iranian economy by impacting Iran’s foreign trade and its access to the global market. These sanctions started from the period immediately after the Iranian revolution. Rasoulinezad (2016, p. 68) asserted, “Sanctions introduced in 2006 are said to have had a crucial effect on the Iranian economy in the last decades and have affected the economic relations between Iran and the rest of the World”. Since the Iranian revolution until now, USA has confiscated US$12 Billion of assets of the Iranian government (Zohary, 2008). Iran’s nuclear program increased international sanctions against Iran, which targeted investments in oil, gas and petrochemicals, transportation technology, the central bank, insurance transactions, and shipping (Zohary, 2008). Furthermore, these sanctions affected the inflation and exchange rate fluctuation, which made trading almost impossible.

Hourali *et al.* (2008) in a study on IS adoption in SMEs, asserted that barriers to IS adoption can be categorized as external and internal factors. Barriers such as obtaining finance, organizational culture, choosing appropriate systems, technical issues and management support are internal barriers, and governmental policy, along with international sanctions, can be seen as external factors.

SMEs generally have limited access to resources compared to large businesses, due to the SMEs' unique characteristics. They normally suffer from a lack of financial resources, technical and managerial resources, and highly skilled employees (Hourali *et al.*, 2008).

Ghobakhlo *et al.* (2012) asserted that financial resources play an important role in SMEs' performance. As implementing an ERP system is expensive and needs long-term investment, lack of financial resources can cause drastic failure. Furthermore, lack of financial resources restrict SMEs from employing expertise, with the resultant lack of technical knowledge when implementing major IS projects.

1.6 Scope and significance of the Study

Because the two topics of ERP implementation and SMEs are broad, researching the entire ERP implementation process, particularly when considering the large amount of relevant literature and due to time limitations, is not manageable. Therefore, this study will limit its scope to the following considerations:

- This study focused on private discrete manufacturing SMEs in the cities of Isfahan and Tehran in Iran. The choice of these two cities is because they are the major industrial centres of Iran, which include the majority of manufacturing SMEs. Therefore, the research study is limited to the context of Isfahan and Tehran. Furthermore, there are few studies available in ERP implementation in industrial manufacturing sectors in Isfahan. Thus, by looking at previous implementation studies and their critical success and failure factors, the study addresses the gap evident in previous research, and has added a new body of knowledge in this area.

- This research discussed several ERP implementation life cycle phases and existing ERP methodologies and the change dimensions that affect the success of implementation efforts.

- This research focused on Manufacturing SMEs in Iran.

This research contributes an ERP implementation model that can be used in the discrete manufacturing SMEs in Iran. This study proposed a conceptual model by reviewing literature on ERP implementation models in SMEs and gaining insights from the essential aspects that influence ERP implementation in discrete manufacturing SMEs. Accordingly, the outcomes of this study should encourage Iranian discrete manufacturing SMEs to invest in, and adopt, ERP systems. The proposed model also will help international vendors to understand the ERP market and discrete manufacturing SMEs needs in developing countries. Also, by identifying the critical success factors of ERP implementation, the study will help practitioners to avoid ERP project failure. Based on ERP implementation models, the researcher will develop practical guidelines for the implementation process to help the project managers and discrete manufacturing SMEs to adopt this system.

1.7 Structure of Thesis

- ***Chapter One: Introduction***

  The introductory chapter provides an overview of the research background and problems, motivation and rationale, following by research questions and objectives and a brief discussion of the research methodology as well as study design and the contribution of the study.

- ***Chapter Two: Literature Review***

  Chapter two reviews relevant literature about ERP functionality and ERP implementation methods in developed countries, then moves on to examine information system (IS) deployment in developing countries. This chapter also reviews ERP market in Iran.

- ***Chapter Three: Conceptual framework***

  This chapter outlines the proposed conceptual model for ERP implementation for the discrete manufacturing SMEs. The discussion leads to the presenting the conceptual model in detail by describing implementation phases, dimensions and elements of change that influence ERP projects.

- ***Chapter Four: Research Methodology***

  In this chapter the adopted research methodology is discussed. The methodology takes a qualitative approach, using multiple case studies to gain an in-depth understanding regarding the nature of IS/ ERP implementation in discrete manufacturing SMEs in Iran.

- ***Chapter Five: Findings***

  This chapter presents results of the questionnaires and interviews from case studies.

- ***Chapter Six: Analysis and Evaluation***

  This chapter discusses the overall findings of the research study by incorporating the findings of the qualitative methods. There is discussion of the findings with reference to previous work identified in the literature review.

- ***Chapter Seven: Conclusion***

  This chapter directly addresses the research questions and assesses the contributions to knowledge and practice. Limitations of the study as well as directions for future research are briefly discussed.

Chapter 2: Literature Review

2.1 Introduction

Creswell (2009) noted that the literature review exposes the results of other studies related to the research topics, helps the researcher to establish the importance of the study, fills gaps and extends prior study. This chapter provides a critical analysis of pertinent academic literature published on the implementation of ERP systems related to the research topic. Specifically, it addresses the issues faced by discrete manufacturing SMEs intent on replacement of their information systems with one integrated software suite – an ERP package.

Grandon and Pearson (2004) argue that only a small number of studies focus on the adoption and use of information systems (IS) in SMEs. Levy and Powel (2008), in support of Grandon and Pearson, have argued IS studies on SMEs have received limited attention in previous works. Among the various information systems, ERP has been one of the most critical applications of information technology in any organization (Davenport, 2000).

However, in spite of the on-going research on successful ERP implementation of SMEs and the growth of IT within SMEs, ERP adoption is relatively limited in developing countries; and it is the large enterprises that have profited more than SMEs in both improved sales and costs savings derived from IS projects (MacGregor & Vrazalic 2005 ; Riquelme, 2002). Hakim and Hakim (2010) argue that successful implementation of ERP systems faces significant challenges and many organizations have reported that their implementation was not as successful as they expected.

Recent research by Wynn and Rezaeian (2015) examines what lessons can be learnt from ERP implementations in UK-based SMEs that may be of value in different socio-cultural-political environments. With similar organisations in the developing world now embarking on such projects, this research can usefully benefit companies faced with similar challenges in a developing world context.

The literature review chapter attempts to collect essential secondary data related to ERP implementation methods and success in SMEs as the basis for the development of a framework and approach for analysing the implementation of ERP systems in discrete manufacturing SMEs in Iran. This chapter starts with the introduction, then moves on to a detailed discussion regarding IS and ERP features in general and in the developed and developing world. Then, this review will focus on IS and ERP deployment in Iranian manufacturing SMEs to examine the level of success in IS and ERP adoption. At the same time, it is necessary to define SMEs and also highlight their importance in the economy; then it will offer an overview of the characteristics of Iranian manufacturing SMEs and their readiness to adopt ERP systems. Subsequently, this chapter discusses the models and methods of IS and ERP deployment assessment; following a discussion of ERP implementation phases and methods. The final point is a conclusion to the chapter.

2.2 Information Systems (IS) and Enterprise Resource Planning (ERP) Systems

2.2.1 IS and IS Strategy

Boncij *et al*. (2006) defined an information system as a set of unified mechanisms that work cooperatively to process, store, and distribute information for more efficient decision making and also support the operational activities within a company. Deployment of information systems goes back to the late 1990s, when a few companies deployed information systems to develop their company business processes, increase their competitive advantages, provide high quality services and also exchange and use information in a more efficient way (Zain, Atan & Idrus, 2004; Caldeira & Ward, 2002; Al-Mabrouk & Soar 2009).

Deploying information systems can lead to business process change. Therefore, in order to successfully adopt information systems, most company business processes have to be modified. In other words, an information system should be aligned with a company's overall business strategy and processes to increase operational efficiency, the overall management of the company, and company profitability (Carmona & Grönlund, 2003). Beynon-Davies, Owens and Williams (2004) categorise information system into operation information systems, management information systems, and decision support systems. As is obvious, operation information systems deal with business operation and everyday activities of a business, while management information systems focus on managerial decision making. Decision support system can be a part of a management information system that supports decision makers to identify and solve problems by analysing and gathering information from documents, raw data, and business model.

Boncij *et al*. (2006) asserted that strategy in business refers to planned actions in order to achieve specific objectives. Al-Aboud (2011) stated that to develop information system strategy, there should be alignments between the organisational context and the business process environment. Akeel, Wynn and Zhang (2013) asserted that development of information systems in developed countries has to achieve some sort of balance and take place gradually in more harmony; the same is true for developing countries.

Any decision regarding information system deployment and information system strategy should be based on business needs and strategies. A well-structured plan to ensure that deployment of information system is aligning with business strategy is an essential step for successful implementation.

2.2.2 ERP Systems

2.2.2.1 Origin of ERP, and future of ERP in developed countries

Origin of ERP Systems

ERP was developed from material requirements planning (MRP), in the late 1980s and early 1990s. MRP systems, which are involved in planning the products or parts requirements according to master production, were developed in the 1970s (Rashid, Hossain & Patrick, 2002). In the 1980s, new software called MRP II placed an emphasis on optimising manufacturing processes by synchronising the materials with production requirements was developed. Areas such as finance and operational planning were covered by this software. Then, following this route, in the late 1980s and early 1990s, ERP systems with the power of enterprise wide inter-functional coordination and integration were introduced (Rashid *et al.*, 2002). Furthermore, in the 1990s vendors extended ERP systems by adding more modules and functions, which included advanced planning and scheduling and e-business solutions such as customer relationship management (CRM) and supply chain management (SCM).

Later on in the 1990s, as a result of increasing need for stronger integration between the departments, ERP was developed to integrate multiple business process including manufacturing, distribution, finance, human resource (HR), project management, inventory management, service and maintenance, and transportation (see Figure 1, below). Rashid *et al.* (2002) assert that these functionalities provided accessibility, visibility and consistency across the enterprise. At the same time, some vendors extended ERP with multiple functionalities (add-ons) including advanced planning and scheduling, e-business solutions such as CRM and SCM (Rashid *et al.* 2002).

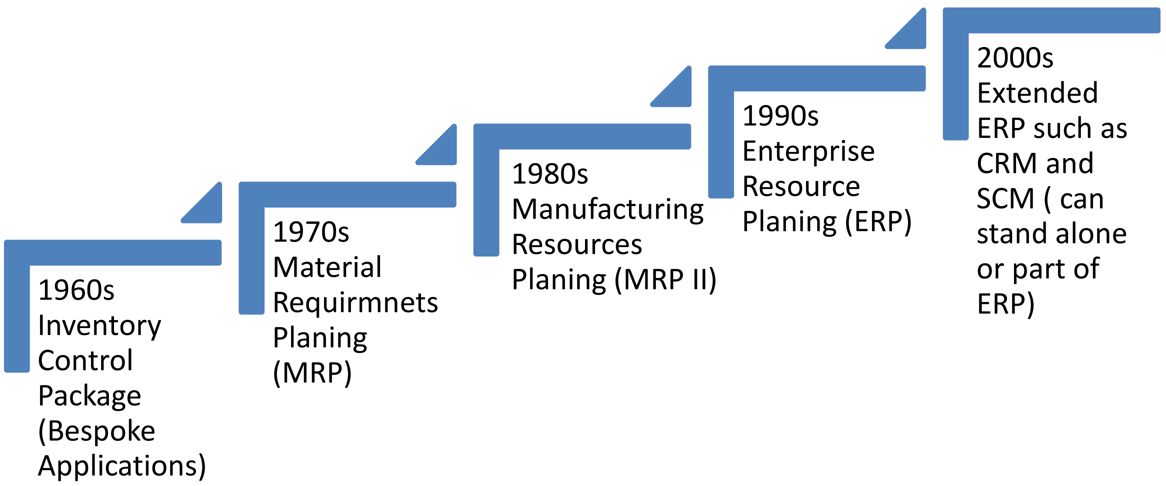

Figure 1: ERP Evolution

ERP software packages have been deployed in the developed world since their emergence in the late 1980s. Whilst it was mainly the large corporations that first implemented these integrated software solutions, the past decade has seen an increase in the take-up of ERP systems by SMEs in the UK (Wynn, Turner, Abbas, and Shen, 2009). At the same time, organisations in the developing world have started to use these systems, with mixed success (Hawari & Heeks, 2010)

Davenport (2000) asserted that ERP is a wide set of information systems, including inbuilt integration, which controls all the business process within the company. Nah, Lau, and Kuang, (2001) defined ERP as business software package with total and integrated solution for business process needs which support businesses to manage the productive use of resources, such as finance etc. Al- Mahshari, Al-Mudimigh and Zairi (2003) suggested that defining ERP systems is not easy, however ERP system can be categorised as the most efficient and practical information system that emerged (Al-Mashari, 2002; Radovilsky, 2004).

Later, in early 2005 Boersma and Kingma supported Al-Mahshari's statement that there is no worldwide definition of ERP systems in the research field. Then, Marnewick and Labuschagne (2005) outlined ERP as business software packages that automate and integrate and standardise business processes to access information in real time within the organisation. Hoch and Dulebohn (2012) explained ERP systems as information systems that support business processes by using modules such as CRM, SCM, HR, finance, and manufacturing. These statements indicate the wide range of applications covered by ERP systems. In general, initially manufacturing was the focal point of this system, but it is now intended to cover multiple business processes, such as accounting.

Norris *et al.* (2000), Davenport, Harris and Cantrell (2004), and Shehab *et al.* (2004) provided a useful starting point and define ERP as a software package which automates and integrates business processes, shares common data, produces and accesses information in a real time environment. According to these definitions, ERP software can also be implemented in stages and therefore be used to integrate previously isolated IT systems and functional departments within a company.

Many researchers, such as Umble, Haft and Umble (2003), Soh and Sia (2004), Boersma and Kingma (2005), Lee, Siau and Hang (2003), and Arif *et al.* (2005) have viewed ERP as a fundamental method for achieving best practice within business operations – the implementation of an ERP package requiring the application of certain disciplines within main business processes. Therefore, these best practices are based on business requirements. As such, vendors offer tailored packages which are suitable for business implementation regardless of the effects that the local situation can have on the implementation process, and business processes. Therefore, as there is no particular way of doing business and environment (such as culture, rules, location etc.) affects the business process, there is no particular best practice for packages. In other words, best practice is what is best in a country or region or even in an organization itself. By considering the above arguments, companies should adopt the package best suited to their business process.

According to Turban *et al.* (2002), ERP not only provides business discipline, it also allows the alignment of IT deployment with overall business strategy and business goals. In line with Turban's statement, previous research (such as Snider *et al*, 2009; Revere, 2004) shows that most global companies adopt ERP to improve efficiency and reduce costs. In other words, implementing ERP may thus also require change in core processes, often termed business process reengineering or 'BPR' (Hammer, 1990). However, the guidance on the mechanics and processes for implementing ERP successfully in SMEs in the developed world is limited (Wynn *et al.*, 2009). Furthermore, in developing countries it has been mainly large companies that have invested in ERP software, and some of these have reported that their implementation was not as successful as they had expected (Moohebat, Davarpanah & Asemi 2011; Hawari & Heeks, 2010). So, to successfully implement an ERP system and also propose a suitable IS solution, the existing business process should be examined cautiously.

Most available ERP systems are designed module by module, due to the different range of processes and sub processes (see Table 1, below) within a company (Hessler & Gortz, 2007; Al- Mashari, 2002; Davenport, 1998). Davenport asserted that one of the main benefits of the modular design is to allow companies to deploy only the modules that align with company processes and sub-processes. According to Keller and Teufel (1998) one of the key benefits of ERP system is the standardisation that is imposed on business processes by adopting such a system.

Functions support by ERP packages			
Financial	**Human resources**	**Operations and logistics**	**Sales and marketing**
Accounts receivable and payable Asset accounting Cash management and forecasting Coast – element and cost-centre accounting Executive information system Financial consolidation General ledger Product- cost accounting Profitability analysis Profit- centre accounting Standard and period-related costing	Human resource time accounting Payroll Personnel planning Travel expenses	Inventory management Materials management Plant maintenance Production planning Project management Purchasing Quality management Routing management Shipping Vendor evaluation	Order management Pricing Sales management Sales planning

Table 1: ERP Functions (Source: Hessler & Gortz, 2007)

Future of ERP in Developed Countries

As it has been discussed before, ERP is in high demand in developed countries. This is particularly evident in manufacturing, service, and energy industries, both among large corporations and SMEs. ERP systems provide a strong integrated solution to a company's information system requirements (Ibrahim, Sharp & Syntetos 2008; Olhager & Selldin, 2003). In turn, developed countries implement ERP to automate the business process to ameliorate process improvements and global competitiveness.

The primary targets for ERP include the USA and Europe (UK, France, Germany), which represent 66% of revenues for the major vendors such as SAP, IBM and ORACLE. The literature review demonstrates that the USA and Europe have a richer experience of ERP implementation and have used this solution for decades. It has been argued by Haung and Palvia (2001, p. 4) that "ERP systems have been widely used by companies in developed countries. Organizations in manufacturing, service, and energy industries adopt ERP to:
1- Automate the deployment and management of material, finance and human resources;
2- Streamline processes and achieve process improvement; and
3- Achieve global competitiveness."

Additionally, companies are keen to invest in newer systems. Combining these two components, organisations are able to develop and connect with suppliers and customers more tightly. On the contrary, some researchers (such as Everdingen, Hillegersberg & Waarts, 2000; Snider *et al.*, 2008; Federici, 2009) believe ERP markets in developed countries, specifically larger organisations, are getting close to saturation. This could be because they have already adopted ERP systems, whilst harnessing the existing infrastructures as foundations for e-business. Federici (2009) stated that SMEs are actually a potential market for vendors. According to Haung and Palvia (2001), strong manufacturing industries, strong national information infrastructure with multi-lingual and multi-currency requirements and having proficient and highly skilled human resources to implement this advanced technology have increased demand for ERP in developed countries.

Haung and Palvia (2001) remarked that, in spite of the high demand for ERP systems in developed countries, a few developed industrial countries (such as Japan) do not seem to have widespread usage of ERP systems and have an exceptional situation. They believe that organizational culture (such as process management, Human Resource) and the geographical location of countries are the main reasons, supporting this statement with reference to the IT limitations in Asian countries and language differences (most Asian countries are a part of the developing countries category). Considering this perspective, companies in developed countries are more ready to adopt information systems successfully.

2.2.3 IS and ERP in Developing countries

There has been ongoing research regarding IS and ERP deployment in developing countries for at least two decades (Avgerou, 2008). However, lack of financial resources, technology and skills are the most common IS failure conditions in developing countries, according to the literature (Avgerou, 2008). Many researchers, such as Wresch (1998), Kenny (2000) Mbarika *et al*. (2003) have emphasised explicitly the lack of appropriate technology in IS/ ERP deployment. A study of the literature on IS and ERP deployment in developing countries revealed that most companies adopt such systems to catch up with technology and automate their business processes and sub-processes (Avgerou, 2008).

There appears to be a significant market for ERP market in developing countries (such as Iran), as the study of Dezar and Ainin (2010) and Aarabi *et al.* (2011) indicate that 90% of business in developing countries are SMEs. Wynn and Rezaeian (2015) also emphasised that there is a great opportunity in the developing world, for researchers and professionals with experience of such projects in the developed world to play this role, distilling the lessons learnt from ERP project implementation in one culture and interpreting and applying them in another.

2.2.3.1 IS deployment in Developing Countries

Avgerou (2008) clarifies frequent IS failure and problematic conditions regarding IS deployment in many developing countries, even if they had successful in trial implementation. A great deal of literature around information systems focuses on IS success, failure, and challenges in developing countries. Most authors (such as Heeks, 2002; Touray, Salminen & Mursu, 2013) debate IS in general, how it can develop and can make positive impact on companies' performance in the developing countries, categorizing IS success and failure by reviewing a large number of developing countries' IS case studies.

Avgerou (2000) concluded that examples of successful IS implementation can be found, but again examples of failure are more frequent. In line with Avgerou's research, Heeks (2002) argued that IS failure can be seen as a dominant theme in developing countries. However, he mentioned that "there is no evidence, nor is there any theoretical rationale, to support the idea that failure rates in developing countries should be any lower than those in industrialised countries, but again there is evidence and there are plenty of practical reasons (such as lack of technical and human infrastructure) that all points in one direction, toward high rates of IS failure in developing countries" (Heeks, 2002, p. 103). As can be seen, IS failure is very common in developing countries, which needs to be addressed.

Heeks (2002) also categorised deploying information systems in developing countries as failing either totally or partially. He classified his case studies outcome into three dominant categories: *total failure* (never implemented or in which the new system was implemented but immediately abandoned), *partial failure* (major goals were unattained or there were significant undesirable outcomes), and sustainability failure, which is another type of partial failure (first succeeds but is then abandoned after a year or so due to lack of update or lack of interactivity). Heeks (2002, p. 102) remarked that one fifth to one quarter of IS projects in developed country fail, between one third and three fifths have a partial failure, and just a few projects are finished successfully.

IS as an essential parameter for economic development, it renews the business process and strategy and generates new business opportunities and many benefits in developing countries (Loukis & Spyros, 2009). Avgerou (2008) emphasised on the impact of IT on organization and social performance in developing countries. The concept of culture has been considered as an important factor in IS research (Myers & Tan, 2002; Walsham, 2001; Westrup *et al.*, 2003; Ciborra, 2005). Avgerou (2008) emphasises national culture and global politics as IS issues in developing countries. She stated that "cultural influence on IS innovation, seen as a historically formed disposition for a particular behaviour, may stem from the innovating organization, its national or regional environment, or the social class of individual actors" (Avgerou, 2008, p.15). In the study carried by Avgerou (2000) indicated that there has been ongoing effort on

IS development and management in developing countries. Avgerou argued that IS has been transferred from advanced economies and adapted to the existing conditions in developing countries, and therefore developing countries' main concern is catching up with the technology and following the advanced technology and rich economy in developed countries (Struab *et al.,* 2001).

An overview on previous IS literature in developing countries shows that, in spite of uncertainly and failure in the adoption of IS, the overall deployment of ERP and IS in general is increasing in the developing world. There remains much disagreement about the effectiveness of these projects and senior management in implementing companies has often questioned the relevance and benefits to their business performance (Heeks, 2002). Although adoption of IS mostly is constructive in both public and private sectors, IS deployment still has not always been successful (Heeks, 2002; Zamiri, Rostampour & Nazemi, 2010).

In a study conducted by Heeks (2002) he identified main issues in the gap between IS designs and local user actuality which helps classify two high-risk prototypes that affect IS in developing countries: country context gap and hard-soft gaps. Heeks' study indicated that gaps are often distant in physical, cultural, economic, and many other ways (see Figure 2, below). He argued that failure also comes partly from economics of business, as organizations in industrialised countries are able to invest more and earlier in new information systems than companies in developing countries. Barrett, Sahay and Walsham (2001) also explained failure in developing countries' information system comes from transferring of industrialised countries' designs to developing countries' actuality. Therefore, design actuality gaps provide an overview of differences between industrialized and developing countries.

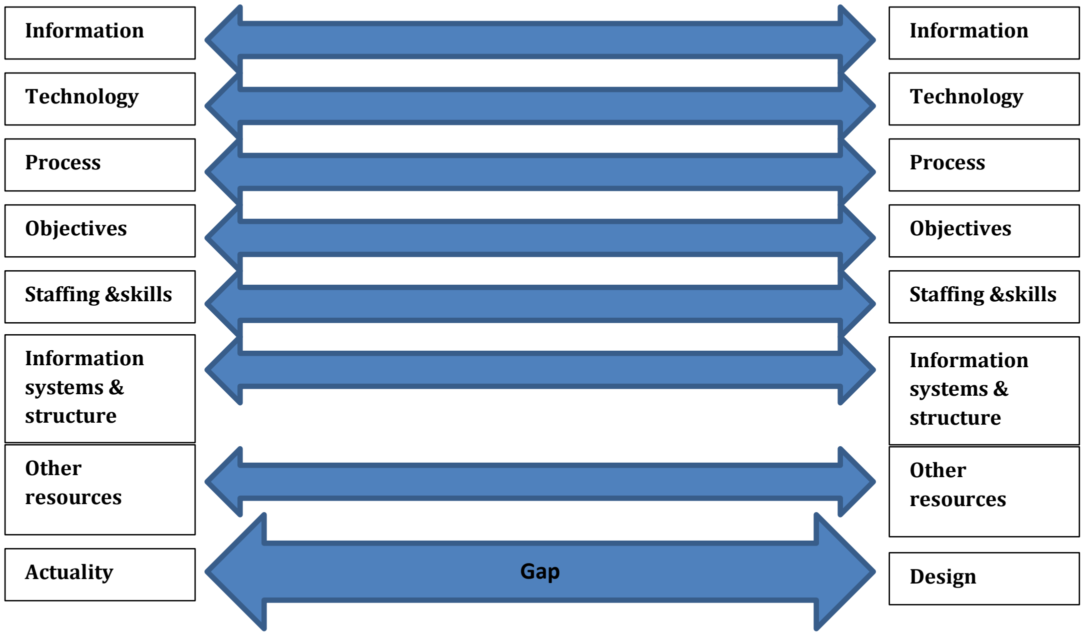

Figure 2: Design- Actuality Gaps (Source: Heeks, 2002)

Heeks stated that today's IS success can be a failure tomorrow, or vice versa. Increasing professional skills and training is one of his solutions for successful IS projects, which are also viewed as a key element for successful IS project delivery by Noudoosbeni, Ismail and Jenatabadi (2010). Noudoosbeni *et al.* (2010) argue that lack of planning and management as well as inadequate training led to IS project failure in Malaysian companies. His study corresponds with the findings of Buruncuk and Gülser (2001), in Turkey. Buruncuk and Gulser mentioned that adequate training and high management and technical skills have positive effects on IS deployment. In the study conducted by Aladwani (2001) he categorised staff resistance to change as a significant critical failure factor, if they feel there is threat to their job. Many researchers (such as Warschauer, 2003; Wade, 2002) believe that lack of human capability and economic conditions in developing countries lead to IS failure and prevent economic growth. From a literature perspective, IS tasks often suffer from a lack of resources (e.g.: financial, skilful employees). For example, lack of financial resources, skills and technical support are the most important factors which degrade IS deployment both technologically and functionally in developing countries. The study of Al-Gahtani, Hubona and Wang (2007) in Arab countries indicated that organizational and social environment in these countries influence IS deployment. Braa, Monteiro and Sahay (2004) emphasised on the impact of local appropriation of the IS resources. In effect, IS should sufficiently cover organizational needs and political commitment to secure the organization growth and ensure sufficient financial and skills resources (Braa *et al.*, 2004).

The studies of Avegerou (2000, 2008) addressed the effects of social context and related organisational change that exist in IS in developing countries, noting that “alternative ways of perceiving the value of technical innovation, often clear in the deployment of ICT in the social context of developing countries, are poorly understood and tend to be dismissed as ‘irrational’” (Avegerou 2000, p. 1). It has been argued (Avgerou, 2000) that developing countries usually have difficulties in hosting IS/ERP. Lack of economic resources and technical capabilities to deploy and adopt IS, and poor exploitation led to IS failure in developing countries. Local culture and political regimes also impact IT adoption and economic performance (Avgerou, 2000).

Generally, in spite of the barriers, and examples of past failure, the use of IS in developing countries is under development. IS deployment is considered to be positive for growth and a transformer for business performance in both large and small/medium sectors in many developing countries, such as Iran.

2.3 The Iranian Systems Environment

2.3.1 Overview of SMEs

SMEs play an essential role in future economic growth and the key element of the global economy (Host Review, 2012) and MacGregor and Vrazalic (2008) stated that the definition is dependent on approaches followed by governments and other organizations in various economies. The World Bank Group SME Department (WGSD) (2004), the International Finance Corporation (IFC) and the World Business Council for Sustainable Development (WBCSD) (2007) all agreed that there was no worldwide definition for SMEs and their characteristics varied from country to country, based on the concerns of each business sector. Following that statement, Devos, Landeghem and Deschoolmeester (2014, p. 12) stated that “there is no single generalized definition for SMEs, but companies with less than 500 (US & Canada) or 250 (Europe and elsewhere) employees” are two generally accepted definitions. For instance, WGSD and IFC (2004) categorize businesses by their revenue and number of employees. Based on their categories, companies with less than $100,000 revenue and 10 or less employees are Micro-enterprises. Companies with the average $100,000 to $3 million revenue and 10-50 employees count as Small enterprises, and companies with average $3million to $15 million revenue with 51-300 employees are Medium enterprises. While the EU Commission categorises SMEs as below:

Business size	***Employees***	***Turnover***
Medium-sized	< 250	≤ € 50 million
Small	< 50	≤ € 10 million
Micro	<10	≤ € 2 million

Table 2: SMEs Definition (Source: EU Commission, 2005)

The European Commission (2008) reported that about two thirds of all the businesses around the world are SMEs. They described SMEs as the economic engines of any country because of their essential role in the economic growth of their country. According to the European Commission, SMEs are the best source for employment, job creation and business opportunity. Consequently, it is important to know what distinguishes SMEs from other enterprises. Lee and McGuiggan (2008) believe that this definition of a company as an SME is based on different features such as turnover, assets, employment numbers, and management.

Haddara and Zack (2011) asserted that globalization, partnerships, value networks, and the huge information flow across and within companies, and competition are main reasons for SMEs to adopt "IS". SMEs in developed countries have adopted IT to support their businesses and compete globally (Host review, 2012), but adoption of such systems by most SMEs in developing countries, especially in the Islamic republic of Iran (Iran) is a new activity, due to the high expense and technical complexity of such systems (Shahawai & Idrus, 2011). Ngai, Law and Wat (2008) argued that SMEs represent a good market for ERP vendors in developing countries.

SMEs are key points in developing countries such as Iran. Accordingly SMEs in developing countries are an attractive market for vendors (especially SMEs), still ERP is in the early stage and there are lots of limitations and issues for adopting such system. However many large organisations in Iran adopt this system (Amid, Moalagh & Ravasan, 2012); still adoption of such system is in its first phase as there are major proportions of failure in these countries. Lack of IT experience, highly skilled project managers, and enough training and etc., impact on successful implementation of this system. There is much research regarding these failures which will be discussed later in this chapter.

Kamalian, Rashki and Arbabi (2011) asserted that SMEs are a main source of employment in Iran but stated that the value added to the country's economy by SMEs, which constitute 94% of Iranian firms, is only 10% of the whole value added in the country. Therefore, attention towards SMEs to adopt IS within the organisation to deliver a state of the art service would be crucial to allowing them to compete globally. Talebi (2007) asserted that the great majority of businesses in Iran are micro, small and medium-sized enterprises (SMEs). According to Molanezhad (2010), the majority of SMEs are in the manufacturing sector. Furthermore, it has been argued by Molanezhad (2010) that due to the significant regional location of Iran in the Middle East, its access to Russia, Europe and Asia, and also its remarkable market size, implementing IS could make more benefits for Iranian SMEs and affect their employment. Therefore, ERP vendors should consider many factors (such as government policy, economic status, ERP implementation methods, and company's requirements and best practice) to increase ERP adoption. Kamalian *et al.* (2011) defined SMEs as independent businesses that employ fewer than 250 people, while Nikabadi and Jafarian (2012) in his study defines small businesses as having fewer than 50 people. Then later, Nikabadi and Jafarian (2012) define SMEs as having fewer than 150 people. However, Ghanatabadi (2005, p. 120) asserted that the "medium-sized firm does not exist according to the law in Iran".

The Iran ECO Trade and development bank (2016) defined SMEs as having 51-250 employees with 51,000-15,000,000 Euro annual turnover. This is in line with the definition of SMEs by the Iran Small Industries and Industrial Parks Organisations (ISIPO), which defined SMEs as having 50-249 employees. According to Bahar (2010) the automotive industry is the second most active industry in Iran. Kalhor (2016) stated that 70% of job opportunities and 50% gross domestic product across the economy depends on small businesses. Moreover, the Iranian SMEs Business Administration (cited in Valmohammadi, 2011) defines SMEs as having fewer than 500 employees; therefore, as this study focuses on automotive manufacturing SMEs, this research uses a definition of SMEs as having 50-500 employees, in the manufacturing sector.

2.3.1.1 SMEs and Big Business

ERP literature indicates that adopting and implementing ERP systems is a complex and expensive task, in spite of the vendor's efforts to customize and match the ERP system with company requirements. While most of the literature concentrates on business complexity and management issues as factors affecting ERP adoption, many studies (e.g. Buonanno *et al.,* 2005; Davenport, 2000; Mandal and Gunasekaran, 2003; Motwani *et al.,* 2002) also raise the issue of company size.

Fuller (2006) declared that SMEs' resource limitation (resource poverty) is the main difference between SMEs and large enterprises. Later in 2011, Haddara and Zack also asserted that SMEs differ from large business and issues such as resource limitation and SMEs specific characteristic in doing business can face SMEs with problem during ERP adoption. SMEs differ from large companies in many characteristics (such as resource limitation), which can effect ERP adoption (Ghobakhloo *et al.,* 2012). Studies carried out by Drew (2003) and Hawari and Heeks (2010) revealed some distinctive characteristics of SMEs, as below:

- A tendency to employ generalists rather than specialists
- reliance on short-term planning
- informal and dynamic strategies and decision-making process
- unwillingness to develop and the use of standard operating procedures

In spite of the above declarations, Poddar (2010) asserted that SMEs can provide "positive externalities" to a domestic market due to their flexibility in operation, rapid decisions making and proximity relations with their customers.

Another issue is that many SMEs adopt ERP because of high competition in the market without having enough knowledge about the systems. Buonanno *et al*. (2005) argued that the most important strategic goal of any information system is its effective use for any company size, but most available ERP systems are too complex and expensive for SMEs. According to Buonanno *et al.* (2005) lack of organisational preparation, information system management, insufficient resources and expertise in IT, and lack of business process culture distinguish SMEs from large organizations. Furthermore, Implementation of ERP in SMEs is more based on external reasons than business related aspects. Large organizations are interested in managing process integration and data redundancy through ERP implementation. Mochoge

(2013) discussed that, with regard to organizational, managerial, technological, individual and environmental aspects, SMEs are weaker that large enterprises. Although there is high demand for implementing ERP systems in SMEs and implementing ERP systems has become critical within SMEs, ERP adoption rate in SMEs is still low and they are still facing many challenges - especially in Iran.

2.3.1.2 Process Manufacturing Vs Discrete Manufacturing

Another factor to understand is the type of manufacturing environment that IS/ERP packages need to be implemented. Manufacturing businesses are classified, based on the way they are operating, as process and discrete manufacturing. This is because the software designed for each functions differently and have their unique requirements. Process manufacturing is based on recipes or formulas to produce a product while it is not possible to unassemble the end product to its original raw materials (such as food products). A discrete manufacturing is based on bill of materials to assemble a product (such as automobiles) which is possible to break down the end product to its original materials (Batchmaster, 2016). Therefore, ERP systems in discrete manufacturing need to be capable of scheduling and tracking an order to improve production. Discrete manufacturers are the main focus in this research.

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2.3.1.3 Readiness of SMEs in Iran

The dynamic business environment in Iran increases the competition between businesses and encourages them to apply information systems to achieve better business opportunities in the marketplace. However, adopting information systems in SMEs can be critical as they need to re-evaluate every aspect of their business process. It is important to review SMEs' readiness and feasibility before adopting information systems to ensure they are ready to adopt, use and benefit from those information systems.

Hourali, Fathian and Montazeri (2008) defined e-readiness as SMEs' ability to successfully adopt, use and benefit from IS. The study of Hourali *et al.* (2008) on Iranian SMEs shows that seven factors are important to measure the e-readiness of SMEs in Iran, which are: level of telecommunications and technical infrastructure; legal environment (legal conditions for IS implementation); Human Resources and cultural infrastructure; management and organizational policy; communication with environment; information technology security (level of IS security); and competitive pressure (compact on IS Implementation). Hourali *et al.* (2008) explained Human Resources and cultural infrastructure refers to the quality and quantity of IT staff and cultural situation for IS implementation, while management and organizational policy defines the level of management support and the company organizational plan in IS implementation in SMEs.

As mentioned before, SMEs in developing countries face many barriers in adopting information systems. Therefore, for successful adoption, SMEs must eliminate these barriers (such as high expense, lack of IT expert), and evaluate company readiness for accepting ERP. It is important to finding out if a company has enough resources, technology and support to achieve such projects. In this study, readiness means company financial resource and budget, management support and capability, company culture and background, technical issues, and governmental supports.

2.3.2 IS and ERP in Iran

2.3.2.1 IS and ERP Deployment in Iran

Information systems have widely supported many organisations and improved the business process and economic success of the organizations. In recent years, the incredible growth of IT and high demand for the use of different types of information systems and their impact on business performance and the local economy has encouraged many developing countries, such as Iran, to change their traditional business processes to this new development. As mentioned above IS deployment is a positive growth for business performance and economic situation in both large and SME sectors in many developing countries such as Iran.

Information systems play an important role in supporting organisation operations in Iranian organizations. Roozbahani, Dosakhani and Nemati (2014) stated that Iranian organizations are facing rapid IS adoption growth. However, Roozbahani *et al.* (2014) argued that in spite of high IS usage in Iranian companies, many IS integration projects end in failure. As discussed, information systems affect business performance and operations efficiency. In Iran, SMEs have played an important role in economic growth and have been targeted as a potential market for "IT" applications. Moreover, adopting IS has a fundamental change on SMEs to increase their business performance and efficiency. SMEs' lack of resources delays IS implementation.

Research of companies in Iran (such as Shahin, Sadri & Gazor, 2010; Hanifzade & Nikabadi, 2010; and Amid *et al*., 2011; Dezar & Ainin, 2012) has highlighted a range of issues that have hampered IS deployment in general in the country - lack of managerial skills, low IT maturity, poor training, poor internet access, governmental policies, and poor business planning; but there is very little literature on the more specific issues faced by SMEs attempting to implement ERP software. There nevertheless appears to be a significant market for ERP software in SMEs in the developing world.

Dezar and Ainin, (2012) considered "organizational culture" as an effective factor in successful IS projects, as do Akeel *et al.* (2013) in research in Libya and Touray *et al.* (2013) who labeled culture and managerial skills as influencing factors in IS projects. Considering above factors, Shahin *et al.* (2010) undertook research on Isfahan Steel Company to address the importance of organizational learning and user training in the IS projects, and to evaluate and find out the level of attention to learning and training, learning required planning model (LRP) has been used. As mentioned above the main concerns regarding IS deployment are lack of technical skills, data consistency and accuracy in systems, and a lack of management supports.

In general, the literature regarding IS implementation reveals great concern about failures within the IS field in Iran (Amid *et al*., 2012). Considering Avgreou's (2008) declaration regarding catching up with technology, it can be argued that this pressure on Iranian companies can increase the potential failure in IS deployment. In line with Avgreou's (2000), Wynn and Rezaeian (2015) also argued the importance of balancing technology change with appropriate parallel change in process improvement and people skills. However, catching up with technology is not the only issue in Iranian organizations; lack of financial resources, training, culture, and politics, all affects IS deployment.

2.3.2.2 The Iranian ERP Market

There are many controversial statements concerning the ERP implementation situation in Iran. Nikookar *et al*. (2010) stated that ERP is a totally new concept in Iran, while Amid *et al*. and Dezar and Ainin (2012) asserted that there is dramatic increase in ERP penetration rate in Iran because the use of the ERP systems has been considered as a key determinant of competitive advantages. However, Amid *et al.* (2012) supported Nikookar's statement by referring to ERP implementation failure and the crucial challenges that Iranian companies are confronted with during implementation phase. Meanwhile, Dezar and Ainin (2012 p. 23) stated that "ERP systems have not occupied their proper rightful position within the organizations and most of the Iranian companies are still unfamiliar with the concept of ERP system" which aligns with Nikookar's statement. It seems that, however the number of users of ERP system has increased, companies are still are facing many barriers in adopting such systems in Iran.

According to the studies undertaken with Iranian researchers (Nikookar *et al.,* 2010; Amid *et al.,* 2012; Dezar & Ainin, 2012) there is no clear and reliable reports regarding to the number of ERP system implementations and activity of international providers in Iran. However, many studies in Iran suggested Oracle, SAP, SAGE, IFS, Epicore, Logo business solutions, Mincom, Netsis software, and 3i InfoTech take the majority of international market share in Iran, but due to the sanctions they operate indirectly (Nikookar *et al.,* 2010; Amid *et al.,* 2012; Dezar & Ainin, 2012). Dezar and Ainin (2012) mentioned that some of these vendors are selling their licence to Iran under another authorization and some of them have their own distributor in Iran, although he does not identify any sources or reports regarding the activity of international solution providers or a third party agent in Iran. There are only few companies using ERP systems (such as Isfahan steel company and Iran Khodro manufacturer). Amid *et al*. (2012,p. 230) remarked that "the first significant ERP systems implementation in Iran date back to implementing Oracle E- business suit in Isfahan steel company".

On the contrary, there are many local vendors that have deployed their own solutions in Iranian companies (Parsi/Persian language). Many studies, for example Dezar and Ainin (2012); Nikookar *et al.,* (2009); Mayeh (2010); and Amid *et al.,* (2012) indicated that these internal providers are not experienced and their solutions may not accomplish the standards of ERP systems. They all agreed that the Iranian developed ERP system has not been designed using industry best practice, but also, there is a lack of proper integration and knowledge of business process re-engineering. Moreover, most of these do not include important modules in ERP systems like Production Planning and Material Requirement Planning. Absence of multi-language and multi currencies to support international companies in Iran, and lack of external interactions with customer and suppliers are some of the limitations mentioned (Nikookar *et al.,* 2010; Amid *et al.,* 2012; Dezar & Ainin, 2012).

However, prior research suggests Iranian companies are more interested in internal developers, as most Iranian companies are SMEs (Moohebat *et al*., 2011; and Mayeh, 2010), and international ERP systems are too expensive for them to adopt. Moreover, the restrictions and sanctions against Iran limit the extent to which international vendors can provide post-implementation support, and as a result businesses face a daunting process toward ERP implementation. In addition, Asemi (2009) mentioned that international ERP has not been very successful in Iranian companies.

<u>Main Characteristics of IS and ERP in SMEs of Iran</u>

It has been argued by Basu *et al.* (2002), the higher dependency level in business on IS to achieve daily tasks, which leads SMEs to pay more attention to the implementation of strategic information systems to facilitate the achievement of the organization's business goals. Also, high levels of competition in the global market, a globalized environment, and high development in information technology and the advantages of "IS", encourage SMEs to adopt IS to reinforce and improve their business performance and their productivity and reform the way their business is conducted. As the extensive deployment of IS leads to opportunities for new businesses and many economic changes, it is necessary for SMEs to invest and adopt IT in their business and derive profit through investment in IT. However, as discussed before, due to SMEs specific characteristics (such as resource limitations), there is different deployment from large organizations.

Hakim and Hakim (2010, p. 207) asserted "IT as a new industry in Iran has not found its rightful place within the organizations, as the managers are still adamant and adhere to the traditional management systems, and show resistance to the required organizational and infrastructural changes". Hakim specified culture and human resources as two main factors which are affecting IT systems developments (Hakim & Hakim, 2010). Bhagwat and Sharma (2007) argue that IT provides required infrastructure (to deliver the right information at the right time) along with competitiveness through integration between supply chain partners and inter-organizational functions that can support SMEs. Manufacturing, health services, educational services and government and public sectors are the main users of IS in Iran. It seems that the driving force behind many economic and organizational changes in Iran is related to the deployment and adoption of IS in organisations (Nikookar *et al.*, 2010).

2.3.2.3 IS and ERP Adoption in Manufacturing SMEs in Iran

In spite of the advantages of IT within SMEs, previous IS literature has indicated there is not much research on the use of IS in Iranian manufacturing SMEs. Furthermore, Iranian IS literature has shown that the proportion of IS adoption in large organisations is higher than in SMEs, because of the SMEs' uniqueness (e.g.: lack of management techniques, lack of global access). Most of the Iranian manufacturing SMEs suffer from lack of management support, such as lacking project management, and financial analyst managers, as they are not keen to employ specialists with high salaries. Ghobakhloo *et al.* (2011) in a study of the adoption of IS in SMEs develops an integrated framework to simply comprise different aspects of internal and external IT adoption and classify factors related to IS deployment within SMEs (see Figure 3, below).

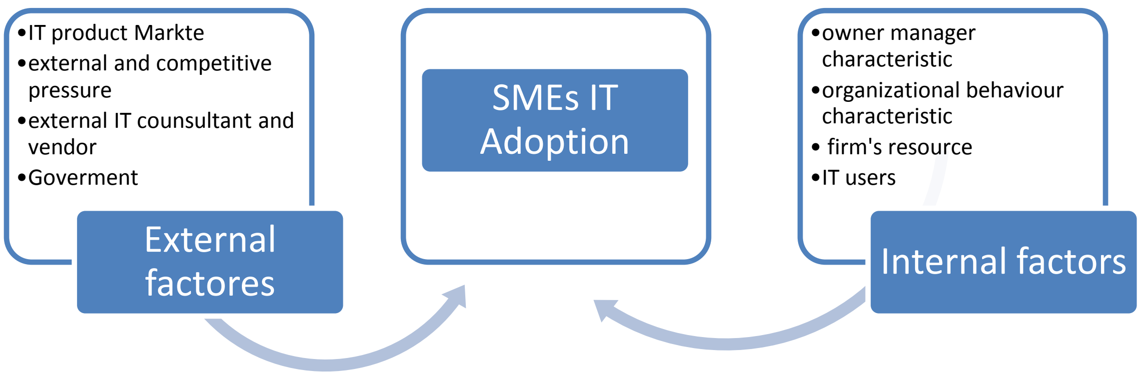


Figure 3: Influencing Factors in IT Adoption Model in SME Context (Ghobakhlo *et al.*, 2011)

Rational for IS and ERP Adoption in Iranian SMEs

A review of literature indicates that improving business performance, reducing labour costs, administration, duplication and errors are major drivers for implementing ERP systems. Many researchers (O'Leary, 2004; Holland, Light & Gibson, 1999; and Markus &Tanis, 2000) categorised the rationale for ERP into three main areas: technical (such as: replacement for legacy systems), operational (such as: process improvement) and strategic (such as: improve business performance and decision making).

Wynn and Rezaeian (2015) study also indicated the motivation for ERP deployment in two manufacturing SMEs in UK. One of the companies highlighted the replacement pf legacy systems and also dire lack of management information and process integration as its main reasons for ERP adoption.

The other company stated its primary reasons as below:

- Limited systems capability, particularly in product costing.
- Existing systems were not well integrated.
- Problematic stock management

IS adoption offers many advantages to Iranian SMEs. There are many potential benefits of implementing ERP system in Iranian SMEs. According to Beheshti and Beheshti (2010, p. 450) "ERP systems provide the platform for SMEs to address the competitive demand for the rapidly changing market place and to be successful in term of: improved customer relations and management, improved cycle time, improved quality, increase sales volume, improved margin, reduce product development time, reduce man power for routine operations and improved market share".

In Iran, large market organization performance is increasingly dependent on SMEs performance (Beheshti & Beheshti, 2010). As a result, more SMEs grow and improve their performance; they more motivated to adopt ERP systems. In addition, needs for collaborative IS partnerships and improving supply chain productivity motivating SMEs to invest in IS. As they grow they need to improve the way they operate in distributed environment, and it is more likely to invest on IS or ERP to experience the benefits of new technology.

2.3.2.4 ERP Critical Failure Factors (CFFs), Critical Success Factors (CSFs), and Barriers in Iranian Companies

ERP Critical Failure Factors (CFFs) in Iranian Companies

Regardless of the high demand for ERP systems in the Iranian market, ERP projects still experience a high rate of implementation failure (Amid *et al.*, 2012). In the study Amid undertook on CFFs in Iran, he developed 16 factors which lead to failure in Iranian industries. These factors are listed below:

1- Absence of an ERP readiness assessment before project implementation
2- Frequent changes in skilled end users
3- Governmental structure of the organization
4- High average age of employees
5- High inflation rate
6- High system complexity
7- Key users' replacement after their training
8- Lack of full time and balanced project team
9- Lack of employee morale and motivation
10- Lack of people skilled in organization's process
11- Lack of process oriented vision
12- Less educated and low skilled employees
13- Low degrees of management tendency to long and midterm planning
14- Poor and insufficient management
15- Poor key users
16- Unstable managerial positions

Amid *et al*. (2012) state that in Iranian companies, short term operational plans are more important than long term plans, which is contradictory with ERP values. Finance regulation in Iranian companies is one of the organizational issues. Amid *et al.* (2012) stated that financial process in Iranian companies delay the implementation of international of ERP system and force vendor to customize their system. This organizational issue causes many internal conflicts among department because of company prevention to accept transformation to fit the system.

Soltanzadeh and Khoshsirat (2012) also emphasise that accepting the transformation from a traditional way of doing business into modern technology to fit ERP system can lead to a successful implementation. Furthermore, most ERP system are off-the-shelf products, so that companies need to change the way they do business. Even if vendors customise the ERP system according to business needs in Iran, it can be a source of technical problem in future.

Lack of IT maturity and clarifying IT strategies to align with business goals is another failure source (Amid *et al.,* 2012). Umble *et al.* (2003, p. 242) states "organizations should be aware, why an ERP system implemented and what critical business goals it will address". This issue repeatedly came in literature and emphasis that misalignment between IT strategy and Business goals lead to failure. Lacks of process management, business process reengineering experience, project manager and attitudes toward organizational changes are another failure factors in ERP adoption process.

Language also is another failure issue, which causes communication barriers between Iranian users and international ERP vendors. Parsi is the official language and spoken by all Iranians, which encourage Iranian companies to select domestic packages (Amid *et al.,* 2012).

Lack of Human resources management is an important failure factor in Iranian companies (Amid *et al.,* 2012). Due to the high level of heavy regulation by government (such as low wages pay by government), employees do not have enough motivation and confidence to recruit qualified people. One of the important issues in ERP implementation involves employees in the whole implementation process, but unfortunately, Iranian organizations do not consider this factor during implementation process. Lack of Training and business process reengineering can be categorised as failure factors in Iranian companies.

Lack of top manager support and low degree of management tendency to the whole implementation process lead the ERP project to failure in Iranian organization. In addition, factor such as lack of support from international vendors and consultants is another failure factor. This issue is because of the international sanctions against Iran, which force companies to choose third party for consultant, or use internal vendors that are not qualified enough in ERP field (Amid *et al.,* 2012).

Organizational	- Governmental structure of the organization - Internal conflicts among departments - Lack of organizational transforms to fit the ERP system - Misfit between organization culture and ERP system - Misfit between organization structure and ERP system - Misfits between the IT and business strategies - No clearly defined strategic goals - Unstable managerial position
Project management	- Conflicts between organization and consultant - Conflicts between organization and vendors - Lack of a full time and balanced project team - Poor project management - Poor risk management - Project cost overturns - Project delays - Scope creep
Human resource	- High employee's resistance to change - Inadequate education and training - Inadequate employee involvement - Ineffective communication with users - Lack of change management - Lack of employee's morale and motivation - Poor key users - Unrealistic expectation
Managerial	- Absence of an ERP readiness assessment before project implementation - Lack of performance measurement system - Low degrees of management tendency to long and midterm planning - Poor top management support
Vendor and consultant	- Poor consultant - Poor vendors
Process	- Lack of process oriented vision - Poor business process reengineering
Technical	- High rate of system customisation - High system complexity - Inaccurate data

Table 3: CFF Factors (Source: Amid *et al.*, 2012)

ERP Critical Success Factors (CSFs) in Iranian Companies

The ERP success factors have been examined widely in ERP literature. The literature indicates that ERP implementation should be completed on time and within budget, achieving business functional goals to be a successful implementation project (Ratkevicius, Ratkevičius & Skyrius 2012).

A review of Iran literature indicates that ERP implementation in SMEs is challenging in all ERP process lifetime and there are certain factors that have an effect on successful implementation such as top management support and commitment (or sponsorship), clear goals and objectives (pre-planning), resources and requirements, project plan, project management and executive management, change management, business process reengineering, selection ERP, avoiding customisation, communication and cooperation, ERP vendors support, user involvement, user training and education, external consultants, and project team competence (Ghobakhloo *et al.*, 2012).

Top management support is one of the factors for successful ERP implementation within Iranian companies. Top management and project success are co-related; more top management of company involve and support ERP project, there is more chance for the project to be successful. Managing the company's overall management team, be in contact with implementation teams, monitor the progress of the project, ensure enough employees and financial resources are available to complete the project with the specific quality and time, evaluate and review technique and solve conflict that may appear in the ERP implementation process are responsibility of top management (Dezar & Ainin, 2010)

Selecting skilful project management team has a positive impact on successful ERP implementation. Zamiri *et al.* (2010) states Iranian organization must have a right project management strategy to manage the implementation process, and ensuring the implementation complete within schedule and enough budget; as implementation process involve all business functions and often require between one and two years of effort. Implementation plan, time schedule, regular meeting, skilful project leader, and having a complete project team including stakeholders are important in project management (Dezar & Ainin, 2010). However, the UK case studies projects suggest otherwise. Wynn and Rezaeian (2015, p. 76) asserted that "as regards the project implementation process itself it is not necessary to follow any specific project management methodology closely – in a manufacturing SME; only selected elements of these methodologies are likely to be appropriate. Slavish adherence to any one methodology is unnecessary and may be counter-productive, but following sound project management essentials is necessary".

In order to avoid failure in ERP implementation, Iranian organization needs to accept change management as critical factor. Neglecting this factor can cause conflict, confusion and errors during implementation process (Dezar & Ainin, 2010). Nah *et al.* (2001) asserted that the "improvisational change methodology" is a practical method for identifying, managing and training changes in implementing ERP projects. Iranian organizations need to have clear goals and objectives of how the company should operate before starting the implementation process. Having clear goals and objective of why ERP system should be implemented and what is business need affects the ERP project success. Clear objectives and planned project empower implementation team and affect the project success (Nah *et al.*, 2001).

ERP system should align with business process; so many vendors need to customize their product to be compatible with company business process. However, as has been mentioned before, too many customizations will be problematic later in the implementation process, updating and maintenance of software, and also increases the level of complexity, risks and costs because of modification, and longer implementation time (Amid *et al.*, 2012). Communication and cooperation with project team, clients and anyone involving in the project is a critical success factor and prevents the project from failure (Amid *et al*, 2012). In other word, Iranian companies should choose standard software, which most closely fits its needs to minimize customisation and increase the success opportunity.

It is really important to choose a skilful and proficient project team. Koh and Loh (2004) stated that ERP team should involve the best people in the organization to lead to a successful project. Furthermore, having skilful team in the entire implementation process to ensure the acceptance of the system by end users and monitor the technological integration with business aspects of the ERP is important in project success (Dezar & Ainin, 2010). Wynn and Rezaeian (2015) also identified the selection of key users and process leaders who will feature in the ERP implementation as CSFs in ERP deployment. The key system users will champion the new system and assess the need for changes in processes and procedures and process leaders will take main responsibility for making the ERP function effectively in their area of influence

Vendor support also affects the implementation process in Iranian organisation. ERP literature continuously emphasises on selecting right and skilful vendor who is professional in both function and business process will prevent failure during implementation process (Koh and Loh, 2004). Third parties, such as external consultants, can facilitate implementation process by suggesting best solution and managing implementation process.

Selecting the right package is also crucial in implementation process. Package functionality must be close to company business process, unless company has to change the way they do business. Involving users from the early stage of process will help implementation process encourage them to accept the changes better, and have more effective training. Training itself is an essential CCF. To avoid ERP failure and make the user comfortable with system, they need to know how the ERP system works, how the ERP is related to the business process. Wynn and Rezaeian (2015) research highlighted a number of guidelines for package selection that can be distilled from the UK case studies projects to support successful implementation. These include:

- Discussions with current ERP software suppliers are important to understand their product development strategy, what functionality will be in their next software releases, and what their underlying database strategy is, and what commercial arrangements and technical links they have with other software vendors. All this can help develop and shape the options for ERP package selection.
- Senior management make and own the decision, and understand the full implications of the chosen ERP product.
- The selective use of proven methodologies for project management and package selection is likely to be of value in small businesses where there is little experience of these procedures.

A review of UK SMEs revealed that at package selection stage, it is of value to re-interview key management and decision-makers in the company to get a top line view of their current and future information needs by using a simple questionnaire, the results of which can be fed into subsequent package evaluation. Furthermore, it is important that company management make and own the decision, and understand the full implications of the chosen ERP product. They argued that identifying at least two ERP suppliers that need to be carefully assessed and costed, alongside making business case for each option with clearly identified benefits and payback periods, are advisable in package selection stage. Having said that, this is not always straightforward, as putting in a new ERP suite of software will often cause significant upheaval and changes in working practices. This needs to be made clear and weighed up in the final decision. A phased implementation plan or roadmap, after the ERP product has been selected and received appropriate budgetary and executive authorization is other CSFs.

Consequently, implementation success can be measured based on time, objectives and cost. Hofwegen (2006, p. 20) stated that "a successful ERP Implementation is based on three criteria; "project cost relative to budget, project completion relative to schedule and level of scope creep encountered".

Barriers to Implement ERP in Iranian SMEs

- ***Top management***

Because top management in Iranian SMEs makes most of the decisions, their attitude toward IT adoption should be considered before adopting an ERP system (Ghobakhlo *et al.*, 2012). Furthermore, Ghobakhlo *et al.* (2012) suggested that management team IT knowledge and experience also can reduce IS failure in SMEs. Considering Ghobakhlo's statement, management team's support increases the level of IS success in SMEs.

- ***Iranian organization culture for adapting ERP***

Many studies on Iranian SMEs affirm on organization culture and its effects before adopting information systems (Ghobakhlo *et al.*, 2012; Dezar & Ainin, 2012). Dezar and Ainin (2012, P. 1127) asserted, "culture is one of the most important and the starting point is to define and understand the vision and mission of the organization, but Iranian SMEs don't have this vison".

Unfortunately, in Iranian SMEs people with experience do not want to share their knowledge with others or record their techniques, as they fear to lose their positions at company by other people. Putting in to the words, those people want to be in centre of attention and a key for company. According to Dezar and Ainin (2012), there is no alignment between the vision statement and the actual work in Iranian SMEs. People in Iranian SMEs do not have clear idea regarding to the company mission. Understanding company mission will lead to the better performance and increase the level ERP success.

- ***Technical issues***

One of the important external barriers in adopting ERP systems in Iranian SMEs is technical issues during and after implementation process. Nikookar *et al.* (2010) categorise technical issues to vendor supports, system quality, localisation, change management, and software and hardware issues.

Unfortunately, due to the sanction on Iran, international vendors do not support (technical and upgrade) their product in Iran. Nikookar *et al.* (2010) regarding system quality asserted that there is lack of knowledge of true concept and feature of ERP systems. However, most Iranian vendors claim that their products are ERP systems, or Total systems.

Localisation refers to the customization or localization of international ERP (such as having Parsi language, or Persian calendar) to align with Iranian SMEs. Another important issue in Iranian organisation is change management. Before the implementation process, employees should be involved in each step of the process in order to prepare them for changes. Unfortunately, in Iranian organization employees resist these changes as they do not have any idea regarding ERP implementation in their company and they think they need to leave their job. Software and hardware issues are another issues bring forth by Nikookar *et al.* (2010). As has been mentioned before, due to the sever sanctions on Iran, most of the software (such as Adobe, Windows) are fake copies which is also true for hardware that imported to Iran illegally. As this hardware is imported illegally, they do not have any support services from manufacturers.

- ***Government support***

Ghobakhlo *et al.* (2012) emphasised on importance of government role and policy on adoption information system in Iranian SMEs. The uniqueness of SMEs from size to resources makes SMEs to depend more on external supports from government to compete in global market. Also Fathian *et al.* (2008) support of Iranian government in some IT projects has result in positive improvement in IT adoption and e-readiness within Iranian SMEs.

2.4 Models and Methods of IS and ERP Deployment

There has always been a growing interest in the success of information systems within an organisation. Petter, Delone and Mclean (2013) emphasised that the complexity, interdependency, and multi-dimensional features of IS hindered early definition of IS success.

In order to understand IS implementation success, many techniques have been developed to evaluate IS deployment success such as Nolan’s Stages of Growth Theory, McFarlan’s Strategic Grid Model, Heeks’ Organizational Change Model, Zuboff’s ‘automate-informate-transformate’ model, People capability maturity model (PCMM) by Curtis, Hefley and Miller, and Capability Maturity Model by Software Engineering Institute (SEI). Furthermore, literature indicates that researchers classified ERP implementation life cycle into different stages. Next two sections will review different assessment models and ERP implementation life cycle stages respectively.

2.4.1 A Review of Main Stream Models

The following section review Nolan’s Stages of Growth Theory, Heeks’ Organizational Change Model, Zuboff’s ‘automate-informate-transformate’ model, Curtis’s PCMM and SEI’s CMM to identify and evaluate elements of change in proposed ERP implementation success in Iranian SMEs.

2.4.1.1 Nolan’s Stages of Growth Theory Model

The Stage of Growth Theory model which developed by Richard Nolan in 1970s is a theoretical model to assess the growth of IT in an organisation. The first proposal of this model by Nolan was in 1974, which were initially four stages. He later modified his model to six stages given how the technology in industry is changing (Nolan 1979). The model sums up the technological adoption process across the company.

The first stage is Initiation stage. In this stage, the new technology is introduced to growing business and IT staff to learn the new technologies, so they can apply the technology into the business. There is only small number of users in his stage. According to Nolan, the new technology is introduced to the business for two reasons. Firstly, business growth, so the business cannot manage the processes without automation and also the success of the business justifies the investment on IT. The second reason is to deal with computational needs. Nolan defines the size of the company as the most common reason for IT needs. The second stage is the Contagion stage. In this stage, IT is proliferated across the business as a productivity tool along with problems raised by users. The third stage is the Control stage. In this stage, organizations gain control over their new technology by placing centralised controls and shifting the focus from management of computers to the management of data resources. The main point of this stage is the restructure of data processing operation. In this stage, the documentation, programming, and operation standards are developed and led by project management team. Stage four is the Integration stage. In this stage, technologies are integrated and users have better control on technologies and they are more accountable for use of the new technology. Data processing has better management control in this stage. The fifth stage is Data administration. In this stage, the focus is on the data management rather that general IT management. In this stage an organisation also focuses on people management and identifies the use of data across the database. Categorising duties and responsibilities are parts of this stage. The last stage is the Maturity stage. In this stage, the systems reflect the information needs of the organisation, and IT has deployed successfully to the business and its structure reflects the business and the information flows across the company (Nolan, 1979).

In spite of being developed in 1970s, this model can still summarise the IT evolution across the organisation. On the other hand, as can be seen, in this model the technology change is the motive/reason behind the IS adoption of the organisation. Regardless of importance of technology change, there are additional dimensions that should be consider during IS deployment which will be discussed later in this Chapter. Awareness of organisation goals, and effective training to increase the user's knowledge, and effective management support are other elements that should be consider during IS implementation.

2.4.1.2 Heeks' Organisational Change Model

Heeks' research (2002) identifies some key aspects of change that provide a frame of reference for effecting the organisational transition associated with, and required by, the implementation of an ERP system (see Figure 4, below). These aspects of change are people, process technology and structure. In line with Heeks' model, King-Turner (2014) also asserts that main success of ERP projects relies on the three pillars of technology, people, and process (see Figure 5, below). He believes that all of these three pillars have to be considered throughout the process.

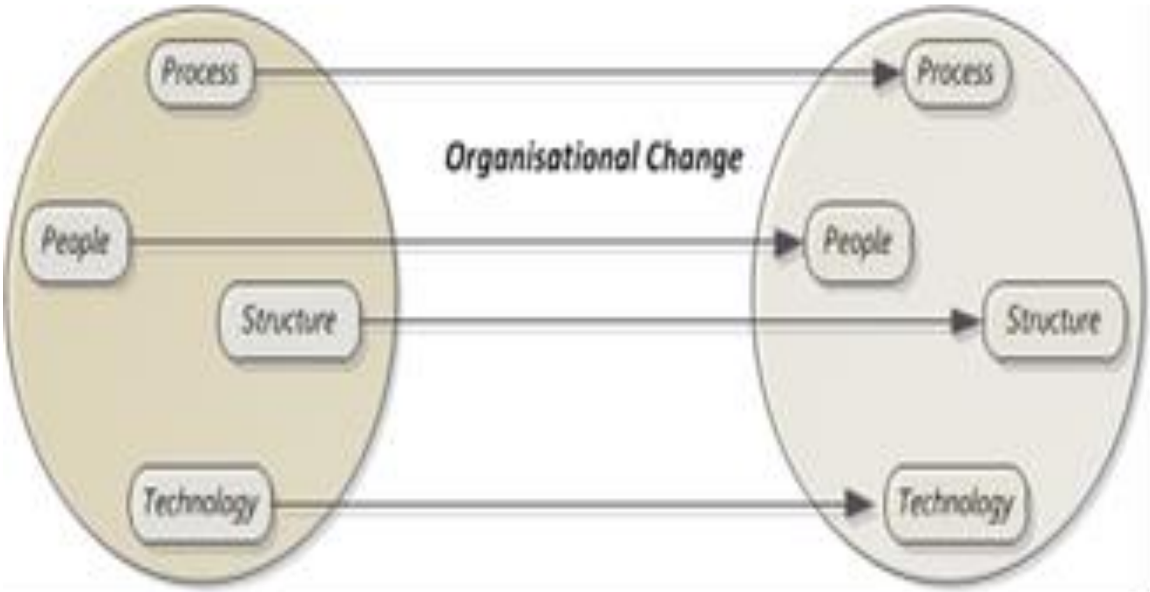


Figure 4: Organisation Change Model

Source: Heeks (2002)

Consequently, ERP implementation will eventually require significant changes to staff and work practices. However, King-Turner (2013) places an emphasis on people, and believes that most of the failure comes from people. "ERP system won't work if the users don't buy-in". Accordingly, if the users do not use the system in the way business want them, it leads to the implementation failures.

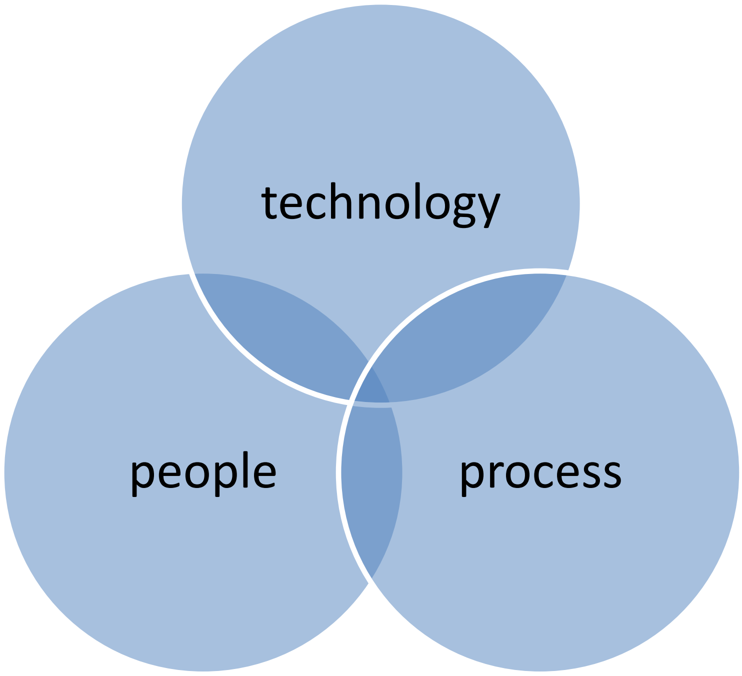


Figure 5: Three Pillars of Success

Source: King- Turner (2014)

Accordingly, employees (not necessarily everybody) will be required to change, such as different way of working, new technology, use of different and/more data, record more data. Another important consideration for employees is that they should feel involved in clarifying the business strategy, and believe that objectives and goals are being shared with them to feel ownership of the new systems and even project. The reason is that, the changes that happen during this process will affect almost every individual in the organization, so it is important to make sure everyone is on board and will help make the project and using the new ERP system a success. Furthermore, Wynn and Rezaeian (2015) also asserted that keeping process improvement and upgrading of staff skillsets in line with technology change is a key to successful project outcomes. They suggest that over-elaboration on process change is inadvisable. A degree of process improvement may be necessary at implementation stage, but this should be strictly controlled by time and resource availability. It should not be allowed to delay agreed implementation timescales. A focus on process improvement in the key areas where new systems were particularly required is likely to be beneficial. Keeping things in balance is key, radical change in a manufacturing SME will be difficult to manage and an incremental, step by step approach is likely to produce better outcomes.

2.4.1.3 Zuboff's 'Automate-Informate-Transformate' Model

Zuboff's model provides an in-depth evaluation of information systems deployment success and will be useful in the evaluation of deployed information systems in Iranian SMEs. This model includes three sequential phases: automate-informate-transformate, which has huge effects on work practices and industry operations (see Table 4, below).

There is significant attention on the technical aspect of IT and IS in the automate phase. The main aim in this phase is to deploy appropriate technological processes in order to condense or replace the human labour in organisation (Chatterjee *et al.*, 2001). Hence, the informate level involves creating new jobs and duties for different employees, and also defining the skills that each employee requires in order to use the information systems. This phase highlights the development of business operations by deploying information system. Zuboff (1998) assert that this phase creates productive reports, which lead to better decision making and also highlights the functional capability of deployed information system. The last phase is transforming the traditional ways of doing business into developed and advanced business processes that bring huge benefits to the business.

Zuboff's model : The three phases - automate, informate and transformate	
Automate	Measure technical aspects of IT (rate of information flow, accuracy, timeliness)
Informate	IT production and project implementation
Transformate	Service perspective, intangible benefits (trust, loyalty, brand, etc)

Table 4: Zuboff's Model

Source: Gomez and Pather (2010, p. 9)

Many researchers (such as Akeel *et al.*, 2013) use this model to assess the level and impact of process change before and after deploying new IS system in SMEs. This model can help this project to assess the impact of ERP deployment at process stage in Manufacturing SMEs in Iran.

2.4.1.4 CMM

The CMM is the developed model by Software Engineering Institute (SEI). This model aims to improve existing software development process. The model describes the elements of process development that guides the company through early ad-hoc practical the way through defined and discipline stages (see Figure 6, below). This model allows businesses to assess their processes to understand the weaknesses and embrace best practice. This model is composed with five levels of maturity that describe the levels a company moves through as it evolves from an immature organisation without process discipline, to a mature organisation where all processes are measured, managed and consistently performed (Harmon, 2007).

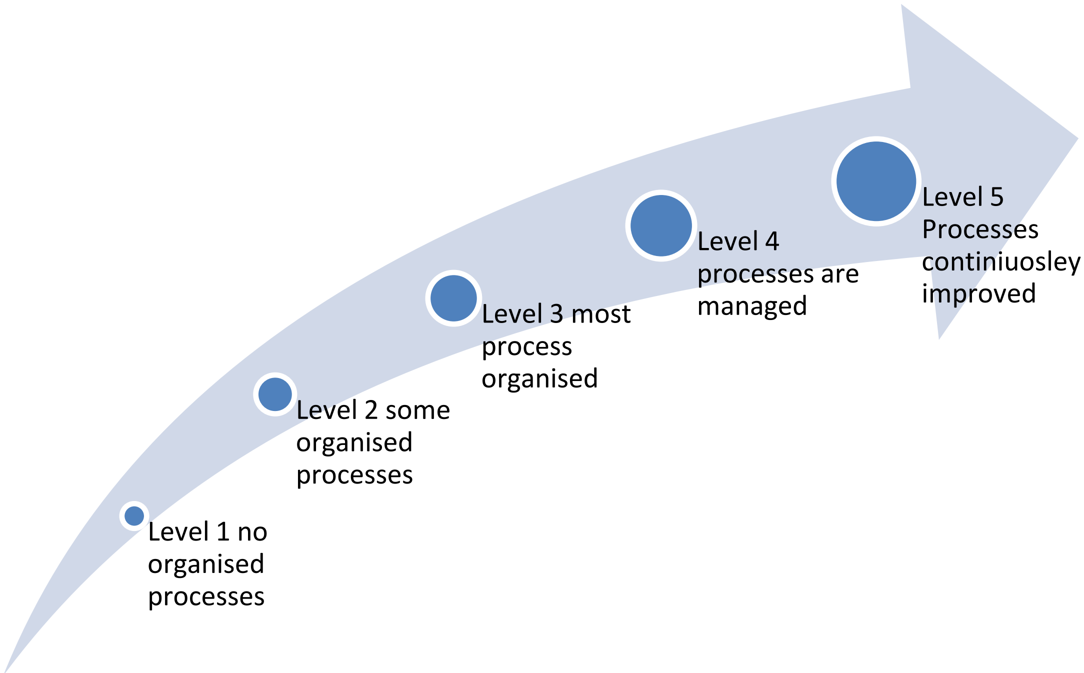


Figure 6: The CMM Model

Source: Harmon (2007)

During the level 1 and level 2, the management processes are improved at the work group level. Throughout level 2 and level 3 the management processes are organised and improved at the enterprise level. As part of level 3 and level 4 the processes are measured and managed precisely. Finally, during the course of level 4 and level 5 the processes teams constantly improve processes. This model allows the organisation to define the key process areas based on business activities and company goals and objectives. As can be seen in the CMM model, the process change is the motive reason behind the IS adoption in the organisation. This model can help the study to assess process improvement during IS/ ERP deployment in manufacturing SMEs in Iran.

2.4.1.5 PCMM

The assessment of people capabilities and skill levels is vitally important. People capability maturity model (PCMM) provides the basis for the development of appropriate training programs, and the identification of systems module owners and key end-users. As has been mentioned before, people play an important role in success of ERP implementation. Curtis, Hefley and Miller (2001) inserted that "organizations are now competing in two markets, one for their products and services and one for the talent required to produce or perform them". They also believe that company success relies on its success in the talent market.

With ongoing development in knowledge (especially technology development), delivering services, and then again competition in market, the retention of experienced employees becomes critical to improving productivity and time to market (Curtis *et al.*,2001). However, only having skilful and talented people is not enough due to continuous and subtle changes in technology and business conditions. Therefore, it is important that a company creates learning environments where people are capable of rapidly adapting to the changes they encounter.

People adjustment and willingness to acquire new skills and knowledge is crucial is ERP projects. PCMM can help current research in measuring current level of people skills and selecting high priority improvement actions based on the current maturity of their workforce practices. According to Curtis *et al*. (2001, p. 107) "the People Capability Maturity Model is a roadmap for implementing workforce practices that continuously improve the capability of an organization's workforce". This model can help to address the critical people issues in organizations and help them to improve their processes for managing and developing their workforce (Curtis *et al.*, 2001).

Curtis *et al.* (2001) divided organizations into their constituent workforces, using competencies to measure and improve capability. He mentioned each workforce competency denotes a unique amalgamation of knowledge, skills, and process abilities developed through specific education or work experience and also can be characterized by its capability—the profile of knowledge, skills, and process abilities available to the organization in that domain.

Curtis study on PCMM indicates an evolutionary improvement path from informal, incompatibly performed workforce practices, to an established setup of practices for constantly uplifting workforce competency. He summarised embedded philosophy in PCMM in ten principles (see Table 5, below).

The philosophy implicit in the People CMM
1. In mature organizations, workforce capability is directly related to business performance.
2. Workforce capability is a competitive issue and a source of strategic advantage.
3. Workforce capability must be defined in relation to the organization's strategic business objectives.
4. Knowledge-intense work shifts the focus from job elements to workforce competencies.
5. People Capability can be measured and improved at multiple levels, including individuals, workgroups, workforce competencies, and the organization.
6. An organization should invest in improving the capability of those workforce competencies that are critical to its core competency as a business.
7. Operational management is responsible for the capability of the workforce.
8. The improvement of workforce capability can be pursued as a process composed from proven practices and procedures.
9. The organization is responsible for providing improvement opportunities, while individuals are responsible for taking advantage of them.
10. Since technologies and organizational forms evolve rapidly, organizations must continually evolve their workforce practices and develop new workforce competencies.

Table 5: The Philosophy Implicit the People CMM

Source: Curtis *et al.* (2001)

This model can help the study to assess people skills during IS/ ERP deployment in manufacturing SMEs in Iran.

2.4.2. ERP Implementation Phases and Methods

Magal and Word (2009) argued that ERP system, as a most complex system in the world, mainly revolves around the processes within an organisation. ERP systems support and integrate business processes such as finance, procurement and warehousing, sales and marketing, human resources, and manufacturing to carry out business operations in more efficient way. Winkelmann (2012) asserted that many businesses adopt ERP systems in order to stay competitive and develop their business strategy.

ERP system's functions are based on the common business needs and can support many businesses. These days ERP systems need to offer a lot of functionality in order to cope with uncountable challenges of business requirements increased in businesses. In order to build better value for the business, the functionality of selected ERP system must be align with business requirements. This functionality needs to be aligned with the business in order to create value for the organisation, confronting the organisation with the options of either configuring the enterprise system, the organisation, or a combination of both (Dreiling *et al.*, 2005).

As ERP systems have been developed by ERP vendors, such as Oracle, Microsoft, SAP, the business that adopts such systems can either accept or reject the selected ERP business process (Gulledge, 2006). Soffer, Golany and Dori (2003) argued that to implement an ERP system includes a process of tailoring the existing package and aligning with the business needs. However, implementing ERP is very expensive for SMEs. Considering the huge cost for implementing an ERP system, it is important before the implementation process to understand what is needed for a successful implementation. Scheer and Haberman (2000) asserted that modelling methods, architectures and tools are important in reducing implementation cost. Some vendors offer specific models according to their ERP functionality on a theoretical level. Panorama Consulting Solutions (2013) reported that at least 10% of businesses realised that their ERP project was a failure. The report shows that this is because of lack of knowledge and understanding of the complexity of such systems particularly regarding business changes and people participation.

Undoubtedly, selecting the right system to align with company business process is essential for a successful implementation. Different ERP systems, depending on industry sector, nature of business and size of company, have different functionality. This functionality correlates to the success of the ERP. However, in the process of implementation, selecting the ERP implementation partner is also important, and this is easily passed over by most businesses. While it may be more convenient for business to use internal IT staff to manage the project, ERP implementation consultants are frequently more sueful, as they are usually more cost effective and are specifically trained in implementing these types of systems.

So as can be seen implementing an ERP system is not an easy task to complete, in actual fact it involves a great deal of planning, consulting and in most cases 3 months to 1 year or more to achieve. It can be more complex in larger organizations. Businesses normally can use ERP vendors or consulting companies to implement their tailored ERP system. There are always professional services to help while businesses implementing ERP systems such as consulting services, customisation and support services. Some vendors sell, implement and support their own solutions directly to any business size. In other approach, some vendors sell, implement and support their solutions by third party organisations to mainly focus on software strategy and development. And some of them use both approaches depending on size, and geographical market situation. Accordingly, it makes it hard for clients in term of choosing the right ERP software and implementation partner approach. In order to help clients to choose the right system, an ERP selection process has been designed. This helps the client to get an idea of the system functionality, and to understand the vendor's implementation and consulting skills.

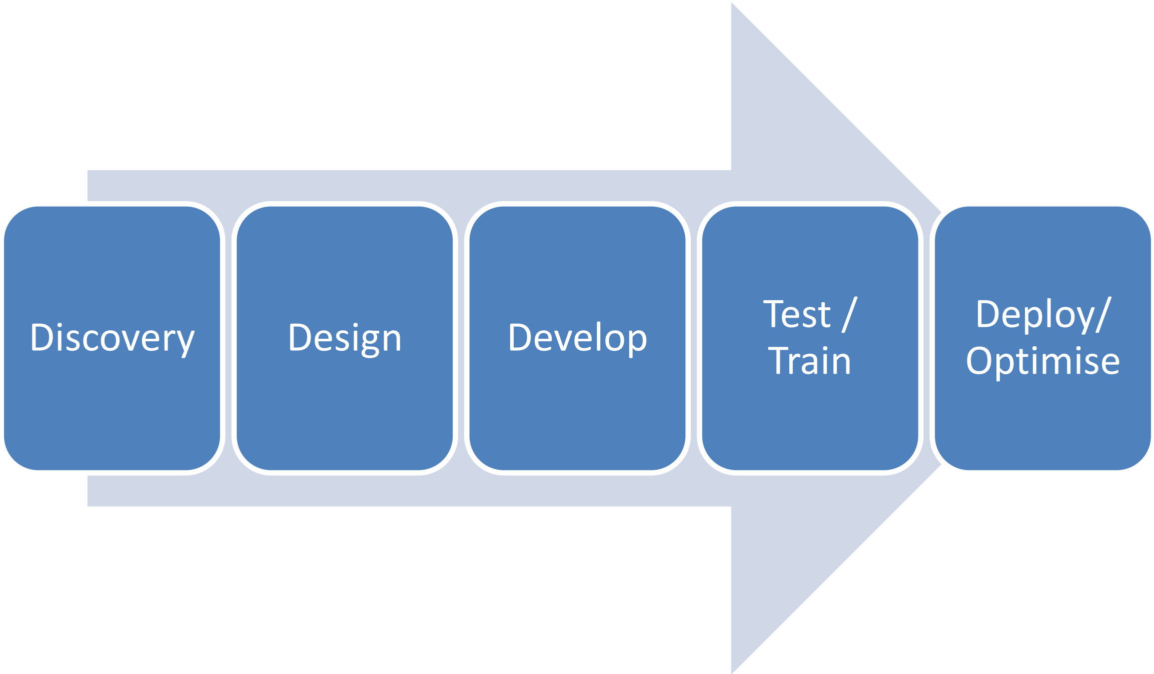


Figure 7: ERP Implementation Life Cycle

Source: King-Turner (2014)

There are many ERP implementation models in the literature, such as Sunders and Jones (1992), Bancroft (1998), Ross (1998), Markus and Tanis (2000), and Parr and Shanks (2000). Some of these models go through different stages. For example, the Markus model has four stages, including: charter, project, shakedown and onward and outward. Figure 7 (above) illustrates a general ERP lifecycle in literature.

The discovery (analysis or Fit/Gap) phase includes: examining business requirements, and how these fit it in with software. In the design phase, the focus is on system configuration (setting up codes and rules and disclosure of Gaps) and customisations. This phase can also help the business to decide how to convert data from their previous system. The development phase can help to outline future business. Training has positive effects on the implementation result. "Big Bang" and "Phased" are implementation models in deploy optimize phases which will be discussed later in this chapter.

The following section reviews several implementation models including Saunders and Jones (1999), Parr and Shanks (2000), Markus and Tanis (2000), Bancroft (1998), Ross (1999), and Esteves and Pastor (1999) to define an ERP lifecycle in context of this research.

- ***Saunders and Jones (1992)***

IS Function Performance Evaluation Model developed by Saunders and Jones (1992) The model concentrates on dimensions of IS performance alongside organisations factors, and other factors that may influence IS assessment such as structure of the IS function and CEO supports. Saunders *et al*. (1992) cited the most frequent dimensions of IS performances as:

- IS contribution to organizational financial performance (e.g., budget performance returns on investment, and costs)
- IS operational efficiency (e.g., system response time, downtime)
- Adequacy of system development practices (e.g., percentage of projects completed on schedule)

Other dimensions in his model are: user and management attitude, personnel competence and development, IS planning, data quality, strategic decision, and finally integration with related technologies across other organisational units. The model also investigates organisational factors such as size, industry, top management supports, etc. The importance of this model is based on the dimensions and related factors that influence IS success, which can support this research. This is because this model evaluates many soft aspects such as decision-making, top management support, and personnel competence and development.

- ***Parr and Shanks (2000)***

Process Phase Model (PPM) developed by Parr and Shanks (2000) consist of three stages and critical success factors. The model focuses on planning, project and enhancement phases. The planning phase refers to activities such as package selection, appointment of steering committee and project team members, defining project scope, determining implementation approach and resources. The project phase refers to different range of activities from ERP modules selection to implementation and goes live. The project phase itself has divided into five sub-phases including set-up, re-engineering, design, configuration, and testing and installation. The enhancement phase covers system repair, improvement and transformation which encapsulate Ross' (1999) continuous improvement and stabilization phases and Markus and Tanis (2000) 'onwards and upwards' phases (as cited in Parr & Shanks, 2000). This model's emphasis on appointment experienced champions with well-defined responsibilities in ERP projects.

- ***<u>Markus and Tanis (2000)</u>***

Markus and Tanis (2000) developed Enterprise System Experience Cycle model. The model has four phases including chartering phase, project phase, shake-down phase, and onward and outward phase. The chartering phase refers to the decision such as package selection, appointment of project manager, approving budget, planning the project and building a business case for enterprise system. The project phase focus on getting the ERP up and running in one or more organisational units. Project manager, project team members, IT personnel, and vendors are the key player in this phase. Shakedown stage refers to the user's familiarity and acceptance of new system across organisation. In this phase, normal operations have been achieved by users. The last stage is onward and upward phase which continues from normal operation until system needs upgrade or replacement.

- ***<u>Bancroft (1998)</u>***

Bancroft developed a five phased model including focus, as is, to be, construction and testing and actual implementation. The focus phase is basically a planning stage that focuses on activities such as package selection, appointing project team and steering committee, and development a project plan. As this phase refers to analysis and defining and mapping business process, initial installation of ERP system, and project team training. To be phase or design phase requires a high level and detailed design focus on user's acceptance and interactive prototyping in tandem with continuous communication with system users. The construction and testing phases focus on development of a comprehensive configuration, testing population of real data, designed interface, created reports, and finally testing system and users. The go live phase is an actual implementation in which the activities are the network building, desktops installation, and planning and managing user training. In summary, the four first stages activities are related to the pre-implementation phase, and the go live phase is related to the implementation phase

- ***Ross (1999)***

Ross's implementation model has five phases including: design, implementation, stabilization, continuous improvement, and transformation. Ross's design phases focus on decisions regarding ERP package selection and if the selected package aligns with business process and standardise business processes. Process Standardisation is the key design decision in Ross model in which managers needs to decide whether to standardize across geographies, product lines, and business units (Ross, 1999). Ross pointed out that the level of standardisation need to be decided in pre- implementation phase, as it is difficult to make changes after new system is in place. The implementation phase refers to actual implementation and goes live activities. The stabilisation phase focuses on cleaning up processes and data and help people fit into the new environment. Training new users especially on business process and working closely with software provider to resolve software bugs are the other activities in this phase. The continuous phase refers to improve the functionalities by adding new modules or other improvement such as adding electronic data interchange, barcoding, sales forecasting, etc. This phase provides the opportunity to redesign and reengineer processes to make them more functional. According to Ross (1999, p.66), "the value derived from the ERP is the direct result of ongoing efforts to instil discipline in the organization and to continuously improve processes". The last phase is transformation phase in which the organisation's performance is analysed to determine the extent of business transformation since ERP implementation.

- ***Esteves and Pastor (1999)***

Esteves and Pastor (1999) developed a model named ERP life cycle. The model has six phases and four dimensions. According to Esteves and Pastor (1999), the phases are the different stages of an ERP life cycle and dimensions are the different elements of change by which the phases could be analysed. The ERP life cycle model phases are: adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement. The dimensions in the model refer to process, people, product and change management.

The adoption decision phase is about defining system requirements, goals and objectives and benefits of adopting ERP system. Acquisition stage refers to activities such as selecting software that best fit business needs and business process to minimise the level of customisation. Selecting Consultant Company to support activities such as implementation is a part of this phase. Analysing the price, return on investment, training, maintenance and defining the contractual agreement are factors that should be consider in this stage. Implementation phase refers to the customisation of package and adoption of new system. The next stage is use and maintenance phase in which the system used and users must be aware of the aspects related to functionality, usability and adequacy to the organizational and business processes. The maintenance and improvements of malfunctions are part of this phase. Evolution phase is related to integration of more capabilities into new system. The last stage is retirement phase refers to replacement or upgrade of the system.

The dimension of process change in this model refers to existing capability of the organisation that need to be supported by new system. The main focus is on business process re-engineering in order to align with ERP system and achieve better performance. The people dimension refers to users and their skills and responsibilities. The development of skills and users' responsibility minimises the impact of ERP adoption to reduce risk, manage complexity, and facilitate organizational change. Product dimension refers to ERP product aspects such as functionality and technical requirements. The process management dimension refers to acceptance and readiness of new system by organisation to gain the maximum benefit of system utilisation.

The importance of these models (outlined in tabular form in Table 6 below) is based on the identification of critical factors, which should be measured and controlled in each phase of implementation. Although the models include differing numbers of implementation phases, some of which are similar but are given different names, the researcher conceptualised that the phases described could be divided into three basic phases: pre-implementation, implementation, and post-implementation (forming the left-hand column of Table 6). These models enabled the researcher to form a clearer picture of the implementation cycle that influences the success of ERP, with a view to applying them to ERP implementation in Iranian SMEs.

Implementation phases	***Parr and Shanks (2000)***	***Markus and Tanis (2000)***	***Bancroft (1998)***	***Ross (1999)***	***Esteves and Pastor (1999)***
					Adoption Decision
					Acquisition
			As is		
			To be or design		
			Construction and testing		
	Set-up				
	Reengineering				
	Design				
	Configuration and testing				
	Installation				
		Shakedown			
				Stabilisation	
				Continuous improvement	Maintenance
				Transformation	Evolution
					Retirement

Table 6: Comparison of Phased Models of ERP Implementation

Source: The author (adapted from Parr and Shanks, 2000; Markus and Tannis, 2000; Bancroft, 1998; Esteves and Pastor, 1999).

2.4.3 Why the Implementation Process is Important

ERP system automates and integrates business process, shares common data, produces and accesses information in a real time environment to improve company performance. On the other hand, the ERP implementation is a complex, time consuming and costly process. However, a successful ERP implementation can cut costs, improve efficiency, customer service, and speed production line.

Therefore, using a structured and disciplined approach can significantly facilitate the implementation process. The researcher has compiled a list of eight recommended factors for a successful ERP implementation, which are: business strategy, goals and strategy, create project team, define project scope, identify requirements, package selections, implementation, and post implementation (optimisation). Put into words, the implementation process is as important as selecting the right software. Next section reviews five common ERP implementation strategies.

- ***Big Bang***

In Big Bang approach, all modules are installed at the same time across the entire organization, and all enterprise functions are transferred alongside with the legacy system to the new ERP system. The implementation requires careful preparation and planning to avoid failure and the many resources required to offer support. As this model is an early and big scope of ERP implementation that can lead to failure.

- ***Phased Transition***

In this method, system modules are installed phase by phase, per unit and per department. Each business unit has its own ERP and database to eliminate customisation risk and operation failure. This is the most commonly used ERP implementation method and works well where there is no centralized synchronization in the project.

- ***Parallel Transition***

This method keeps both systems active and in operation for a length of time going from one day to several months, and sometimes for years. Both ERP systems are running alongside, which allows for fixing bugs and customisations without affecting workflow; and also, if a module breaks down, then the other business processes are not affected.

- ***Process Line Transition***

Process line transition is used on product lines or process flows and related assets. This approach is useful when you need to build industrial faith on a new system with the goal of increasing its overall success.

- ***Hybrid Transition***

The most ideal approach is hybrid transition because of its flexibility in adapting to business specific needs and its capability for special modifications based on industry needs. This approach is a combination of above implementation approaches. Selecting the right approach is depending on the size and business type.

2.4.4 ERP technology

- ***Platform***

Cloud (Software-as-a-Service (SaaS)) and on-premises ERP are evolving as known solution methods for hosting ERP systems. In on-premises solution the ERP modules are hosted in house in the company, whereas in cloud solution the software is provided as a service and software are managed centrally in the in internet by the vendor. There are three types of Cloud services (see Figure 8, below). Saas and Iaas are more suitable for ERP. Table 6, below briefly compare Cloud service and on-premises platform.

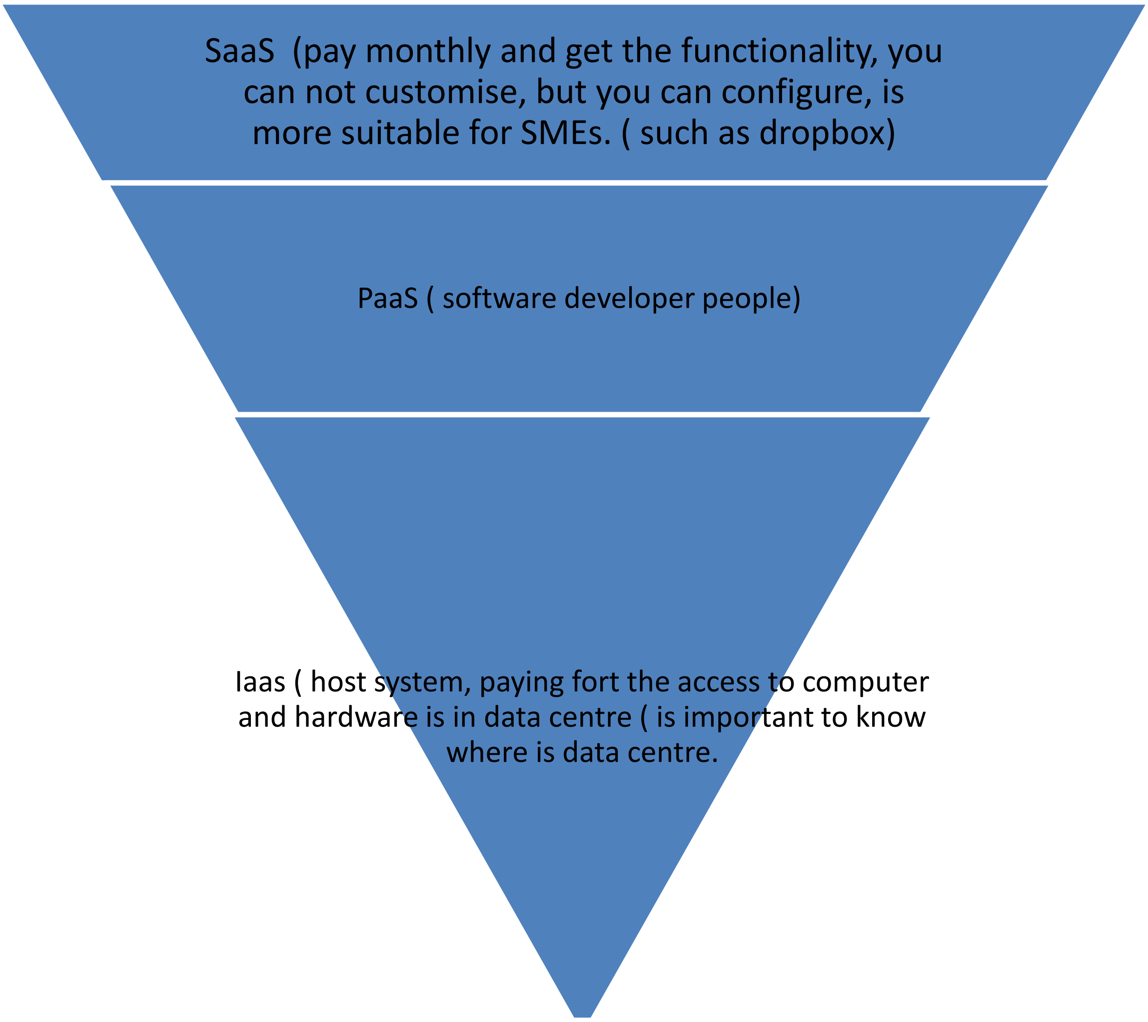


Figure 8: Cloud services

Source King- Turner (2014)

Pros	Cons
No Server Maintenance – You no longer have to manage your own hardware and software. This opens up office space, eliminates maintenance costs, and reduces electricity use.	Total cost of ownership (TCO) - Paying a low monthly subscription for software certainly helps a company's cash flow. However, over the long term, the software can become more expensive.
Reduced Costs - When you have your application running in the cloud, the IT staff doesn't have to worry about servers, networking and operating system software support. Those things are being taken care of by the cloud provider.	Data control - Having an on premise solution may make sense when you need to keep sensitive or regulated data local
Improved Cash Flow - When deploying a large system on premise that requires multiple servers and software, a large, up-front cash outlay is also required. When using a cloud, normal charges are billed on a monthly basis as an operating expense rather than a capital expense. This improves a company's cash flow.	Outside risks - When software is hosted on premise, everything resides within your company walls. When it is hosted in the cloud, the cloud provider has access to and control of the hardware and software. Before selecting a cloud-based service provider, evaluate and set the level of control in the service level agreement.
Mobile Computing Made Easier - Most companies have complicated security protocols but with the cloud access, authorizations are taken care of effortlessly.	
Superior Integration With Other Systems – The cloud was purposefully designed for easy interoperability, which adds the option for current or future usage of additional products.	
Faster Implementation – Cloud ERP solutions are managed and hosted by the vendor therefore you do not need to set up or install any hardware or software.	
Data Back-Ups – As opposed to the horrible risk of crashing your in-house server(s) and losing data, third-party hosted ERP clouds have redundancy. That means that your data is copied to at least two locations, so if one fails you still have not lost anything.	

Table 7: Comparison of Pros and Cons of On-premises and Cloud Services

Source King- Turner (2014)

2. 5 Summary

This research work investigates the ERP implementation in the discrete manufacturing SMEs in Iran. It mainly focuses on factors associated with the implementation of the ERP in manufacturing companies, and thereafter proposes a new framework for implementing ERP systems in the discrete manufacturing SMEs in Iran. The literature is mainly concerned with the current situations of IT and IS applications in general and existing ERP applications in particular in Iran.

The literature indicates that there is a considerable interest in successful ERP implementation and highlights many failure and success factors and best practices for future consideration with regard to ERP implementation. However, understanding each strategy and choosing the best option is difficult. Implementing new information systems is not easy and many ERP projects fail or fall well short of their expected outcomes, although there are some recent examples of success in this field in the developing world (Akeel *et al.*, 2013). McAfee (2003, p. 84) noted that "the coordination, managerial oversight and marshalling of resources needed to implement these systems make for a change effort like no other". Furthermore, recent research on ERP implementation in manufacturing SMEs in UK by Wynn and Rezaeian (2015) indicated that in the developing world, there is a great opportunity for researchers and professionals with experience of ERP projects in the developed world to distil the lessons learnt from project implementation in one culture and interpreting and apply them in another. Over and above all this, and in the specific context of ERP systems implementation, is the more general need for the financial and human resources to undertake such a major project, which can seriously disrupt a company for the project implementation period and beyond. This research notwithstanding, has also attempted to advance the transfer of learning by discussing an approach to ERP project implementation, to apply and further refine in the context of similar projects in Iran.

This chapter has reviewed the literature related to a variety of aspects of SMEs in developing countries such as information systems adoption, and ERP implementation, particularly manufacturing companies where ERP systems have been implemented in Iran in recent years. Information systems, information systems strategy, ERP systems and ERP implementation in developing been discussed. Relevant and established models for assessing deployed information systems and information systems strategy implementation in discrete manufacturing SMEs have all been discussed in this chapter.

When discussing IS in the developing world, many scholars such as Heeks (2008) observe that there are considerable failure factors in ERP implementation revealed in literature for developing countries. In this chapter, the work of other scholars and academics indicated that there is a gap between theory and practice in successful ERP implementation. So in the light of this gap the researcher aims to study ERP implementations process in discrete manufacturing SMEs in Iran. Within this context, and in accordance with the research aims and objectives, the aim of this study is to answer the following questions about the Iranian SMEs in respect to the conceptual framework identified from the literature review:

1. What is the extent of ERP systems implementation in Iranian SMEs?
2. What has been the nature of ERP implementation? Have the change dimensions of technology deployment, process improvement and people skills enhancement been in balance? What have been the critical change elements or factors?
3. What new framework can be developed for Iranian SMEs to adopt and implement ERP systems to improve their business performance?

The next chapter explains and describes the proposed conceptual model for ERP implementation in automotive manufacturing SMEs in Iran.

Chapter 3 Conceptual Framework

3.1 Introduction

After exploring the relevant literature, this chapter focusses on three main dimension of change (people, technology, and process), as introduced by Heeks (2002) and King-Turner (2013), in order to develop a conceptual framework to assess ERP implementation in manufacturing SMEs in Iran. Building upon these models, the three main elements of change provide a frame of reference for analysing the organisational transition associated with, and required by, the implementation of an ERP system.

There are various frameworks, models and tools which have been designed by academia and IT consultants to evaluate information system adoption in developed countries, such as the Automotive, Informate, Transformate Model (Zuboff, 1998), People Capability Maturity Model (Curtis *et al.,* 2001), and Stage Growth Model (Nolan, 1979) and many others. In addition, System profiling and process mapping give an assessment of current technology capability at a processing level and provide an insightful analysis of each process situation. Process analysis, producing 'current' and 'new' process maps, also feature in some IS strategy development models; and data analysis and data modelling can also play an important role in determining what systems are required.

The chapter starts with the introduction, there then follows the explanation of the proposed conceptual model for ERP implementation in manufacturing SME's in Iran, alongside reviewing the main elements of change in order to assess ERP implementation in Iranian companies. As a final point, the summary of the chapter is presented.

3.2 A Conceptual Model for ERP Implementation in Iranian SMEs

Yu (2005) asserted that ERP implementation is an important milestone to start continuous improvements in organizations. Furthermore, Wang, Shih, Jiang, and Klein (2008) believed that an ERP system can be considered successful when the organization achieves its goals. Boltena and Gomez (2012) stated that the implementation of ERP systems is more difficult than the development of a computer application supporting a single business function. However, evaluating this achievement is a difficult task due to the complexity of ERP systems. As discussed in chapter 2, there are many ERP implementation models in the literature that support vendors and business to implement ERP. Bancroft's model (1998) focuses on project activities whereas Ross (1999) validated Bancroft's model by applying it to several case studies along with post-implementation factors. The ERP life cycle model by Esteves (1999) focuses on pre-implementation phase (adoption decision and acquisition), implementation through to a comprehensive post-implementation by including evaluation and retirement elements. Markus' model (2000) focuses on factors that influence the ERP success while the project phased model by Parr and Shanks (2000) follows a collaborative tactic by using existing approaches.

Heeks' model (2002) identifies some key aspects of change that provide a frame of reference for effecting the organisational transition associated with, and required by, the implementation of an ERP system. Heeks (2002), put forward four aspects of an organization that must change as it adopts major new IS. He sees these as constituting a 'Design-Actuality' gap – i.e. a gap between where an organization may be currently, and where it needs to be to successfully adopt major new systems. ERP implementation will require significant changes to processes, staff skills and work practices, as well as technology capabilities. In line with Heeks' model, King Turner (2013) has more recently argued that the success of ERP projects relies on the three elements of technology, people, and process. ERP implementation will require significant changes to processes, staff skills and work practices, as well as technology capabilities. Structure may change also, but this is seen as a function of major process change, and thus is omitted from our analysis as a main dimension. For example, company structure such as the functional relationship between the Production department and the Marketing department might be changed by ERP implementation, but this is an outcome of a change in the process dimension and is therefore, notwithstanding Heeks (2000), not considered as a separate dimension in this study.

Developing a new ERP implementation model for discrete manufacturing SMEs is the main focus in this study. After evaluating factors that influence ERP project success concerning different implementation phases, the conceptual model was developed based on factors found in previous models; however, in this study, a phased implementation process based on the dimension of technology, people and process was adopted. Whereas previous researchers (e.g.

Hakim and Hakim, 2010; Dezar and Ainin, 2010) have divided factors affecting ERP implementation process into external and internal, this study is more interested in their effect on the dimensions outlined below (in Figure 9). When Ghobakhloo *et al*. (2012) focus on SMEs and divide the factors influential on ERP implementation into external and internal, they are providing an overview of many previous studies and conclude that in terms of an ‘external’ factor such as government intervention is concerned, the findings are inconclusive and that “government assistance has generally not been found to be helpful” (p. 54). Moreover, Hakim and Hakim (2010) found that although sanctions could be regarded as an external factor in Iran, in fact most Iranian SMEs base their decision to purchase local ERP systems on their price, compatibility with the Parsi language and correct Persian calendar. Therefore, this study will focus on the effect of factors on the dimensions regardless of whether other studies define them as internal or external. According to Markus and Tanis (2000) in order to assess the importance and level of change elements during each phase, there should be a link between elements of change and phases of ERP implementation. This provides an in-depth understanding of which factors influence project success in which phase. Therefore, in this study a phased model with associated dimensions and related elements of change has been developed (see Figure 9, below).

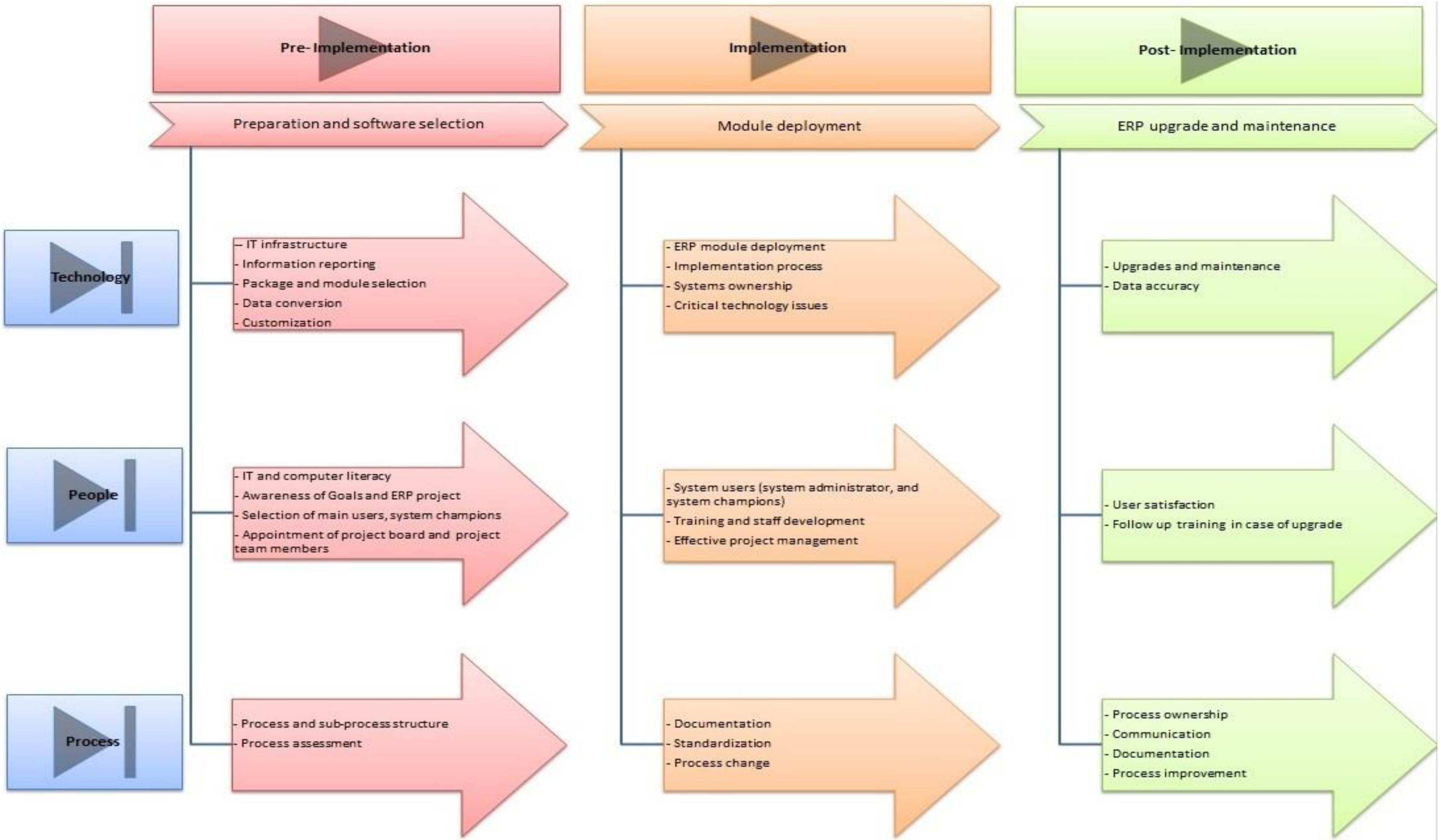


Figure 9: Conceptual Framework

The model has three key dimensions and three phases and change elements that influence ERP project. The structure of model is discussed in the next section.

3.2.1. ERP Implementation Phases

As shown earlier, the existing model in literature has different stages. ERP implementation in this research uses a three-phase implementation life cycle encompassing a "pre-implementation phase", an "implementation phase", and "post-implementation" (see Table 8, below). After exploring relevant literature and Heeks' IS success model, the dependent variables that affect ERP implementation success in all phases are defined. The entire implementation process focuses on three change dimensions: technology, people, and process. Moreover, these three dimensions of change (people, process, and technology) must be kept in balance when implementing these major software suites, both in developed and developing world contexts (Wynn and Rezaeian, 2015). A conceptual framework is developed and illustrated in Figure 10, above.

3.2.1.1 Pre- Implementation Phase

From a sequential perspective, the pre implementation phase consists of two main stages:

Selection Stage

The selection stage in people dimension establishes an organisation project board and project team. Project board includes directors, and top management to support the project and software implementation decision, manage the financial guidance of the project and identify required resources. Moreover, project board are responsible for identifying roles and responsibilities for new systems users, select the main users and system champion, and communicate with the implementation team. The project team includes project manager, IT representative, process owners, user representative, and software suppliers to administer and supervise, control and manage the actual implementation life cycle.

Within the technology dimension at this stage, the project board is responsible for selecting suitable packages and modules. Data conversion and identifying the software customisation and the type of report different users will need, is a decision that should be made by the project team and project board.

Preparation Stage

The preparation stage within the people change dimension can be viewed as identifying organization strategy, readiness of company and level of acceptance in staff and awareness of goals and ERP project, and IT and computer Literacy. The technology aspect, at this stage, looks at existing IT infrastructure to prepare the company's move to the new IS system. Finally, the project team is responsible for identifying the company's main business processes and sub-processes structure, assessing current processes in order to identify which process to modify and which one to change. At this stage, the scope of the project will be defined, and an outline plan and costing provided.

3.2.1.2 Implementation Phase

The core implementation process again focuses on three dimensions of change. In people change, the focus is on selecting system users, (system administrators, and system champions), training and staff development, and effective project management. The project manager should plan, lead and manage the implementation process deliberately. Documentation and standardization of the processes, sub-processes, and process assessment are elements of process change in this phase. The actual implementation process, ERP modules deployment and data migration take place in this phase. The system ownership should monitor and lead the system upgrade to identify the technology issues for potential changes or maintenance.

3.2.1.3 Post- Implementation Phase

In the post-implementation phase, there is a need to identify problems and measure the operational performance for maintenance and also future upgrade (Technology Change). Reviewing and modifying documented processes and sub-processes for further adjustment and performance, alongside precision of input data is essential (Process and Technology Change).

The processes and sub-processes still need to be managed and analysis by process owner. All standards, or any changes, should be explicitly communicated to the employees (Process change). Companies need to assess user's satisfaction and provide regular training as a reminder (people Change).

Change Dimensions	**Implementation Phases**		
	Pre implementation	**Implementation**	**Post implementation**
Technology	• IT infrastructure • Information reporting • Package and module selection • Data conversion • Customisation	• ERP Modules deployment • Implementation process • System ownership • Critical technology issues	• Upgrade and maintenance • Data accuracy
People	• IT and computer Literacy • Awareness of goals and ERP project • Selection of main users, and system champion • Appointment of project board, and project team	• System users (system administrator, system champions) • Training and staff development • Effective project management	• User satisfaction • Follow up training in case of upgrade
Process	• Process and sub-process structure • Process assessment	• Documentation • Standardisation • Process change	• Process ownership • Communication • Documentation • Process improvement

Table 8: The Three Phases of an ERP Project

3.2.2. The three Change Dimensions (Process, People, and Technology)

The advantage of ERP deployment is exceptionally reliant upon the degree of its success (Boltena & Gomez, 2012). In order to get the best out of an ERP system, the implementation must mainly oversee the three main elements of change rather than a software adoption itself.

3.2.2.1. Technology Change Dimension

The Technology change dimension focuses on which functions, platforms, and software, determining which implementation model should be adopted (see Figure 10, below). ERP literature continuously places great emphasis on selecting the right vendor, who is professional in both function and business process. This will prevent failure during the implementation process (Koh & Loh, 2004). Before deploying an information system, it is important to investigate and understand the company business plan and the key goals and objectives for the next 3-5 years. Selecting the right package is also crucial to the project. Package functionality must be closely aligned to the business processes of the company, otherwise the company has to change the way they do business. It is also vital to know how many modules should be implemented, and if their functionalities fit the unique company requirements.

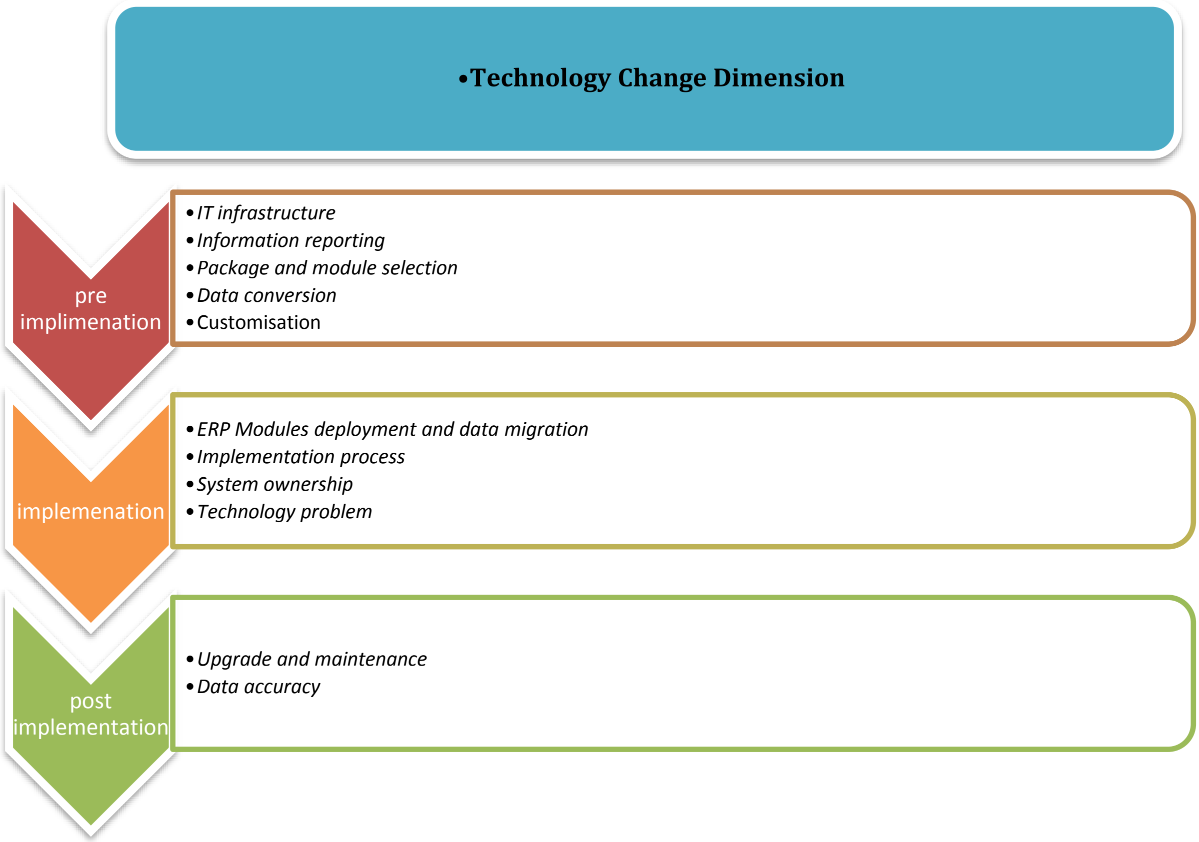


Figure 10: Technology Change Dimension

Assessing technology change in the context of this research is clearly demonstrated at each stage of the ‘implementation life cycle. The first phase (pre implementation) starts with profiling the current system to identify which systems, if any, are strategically sound, which systems are missing or need replacement, and which lies somewhere in between – possibly redeemable, but possibly in need of being replaced, (preparation stage). This can be done by mapping systems to business processes and starting to apply a simple Red-Amber-Green (RAG) assessment of main systems and applications. The next step is to select software, modules, functionalities and platform (selection stage). In this stage, establishing what data is used where, and what information is needed to support current and future company requirements can be helpful. Nevertheless, it is useful to establish in what current systems the main corporate data entities (normally customer and product data in a manufacturing SME) are entered and updated, and if there are any significant data duplication problems caused by multiple data entry in different systems. This will be of value in highlighting where data maintenance issues have to be addressed. It is also useful as a top-level guide for data cleansing and migration of data to the new ERP product in due course. During the implementation stage the focus is on phased implementation, and system ownership to understand level of technology change. This is to help to identify the improvement of system and implementation success. Finally, the post implementation phase identifies system upgrades and changes or modification to the system.

3.2.2.2 People Change Dimension

Implementing ERP systems confronts employees with radical changes in their jobs briefs and this will eventually require significant changes to staff and work practices. Employees will be required to change and more importantly they should feel involved in that stage. It is therefore crucial that employees understand the business strategy, and that goals and objectives are shared with them in order for them to feel ownership of the new system and the project. In order to assess the people change, in the context of ERP implementation, the focus is on a number of factors that have been identified in literature, such as top management support and employee’s engagement (Jarvenpaa and Ives, 1991; Heeks 2002; King-Turner 2014), the need for project champion (Beath, 1991), alongside user training (Nelson and Cheney, 1987) and staff development.

As mentioned above, in the context of this research, the pre implementation phase includes preparation and selection stages. The preparation mostly identifies influential employees, who are seen to have an impact on other employees and identifies how many main users are involved in current processes, and in setting roles and responsibilities. In this phase, it is important to consult the management and operatives in each process, individually or in joint workshops, and other staff – notably any existing IT support staff – should also be involved. These are simple but effective tools in developing and communicating an assessment of the current status quo and can help give momentum and generate support for the project. The selection stage in people change, identify main users for new system, the system admin, the project champions, and help establish a project team and steering committee, besides identifying people who need training. The assessment of people's capabilities and skill level is vitally important at this stage. This can provide the basis for the development of subsequent training programs, and the identification of systems module owners and key end-users. It is these personnel who will champion the ERP product, and be responsible for a range of issues relating to system configuration, user access and package upgrades.

The core implementation process not only focuses on participation and involvement of key participants and system admin, but also reviews training programs and training types. Post implementation phase identifies user satisfaction of new system, besides regular training, in case of any upgrade in process, or any changes in employees or responsibilities (Figure 11, below).

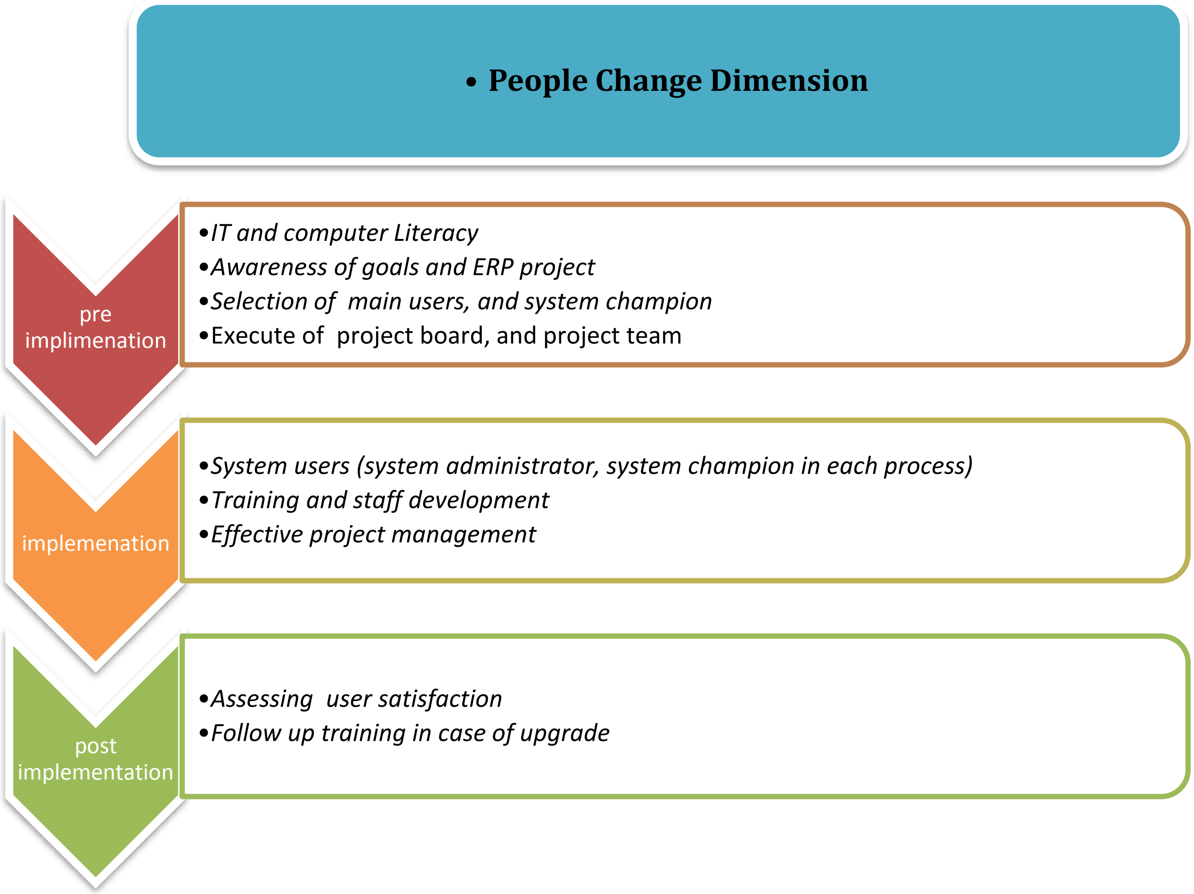


Figure 11: People Change Dimension

3.2.2.3 Process Change Dimension

A degree of process improvement may be necessary at the implementation stage, but this is strictly controlled by time and resource availability. A focus on process improvement in the key areas where new systems were particularly required is likely to be beneficial. In order to evaluate process change, the focus will be at level of process change in three stage of implementation life cycle identified in this research.

The process change assessment starts with process mapping the current system in order to understand company business process and determine capabilities of a company and its IT departments. This helps the company to identify its main objectives, which process needs to be changed and which standards for each process, (such as operative or production procedure) in order to define the company process and sub-process.

The implementation phase involves standardization and documentation. This phase highlights the development of company process and making sure the adoption processes are in line with industry standards. Documenting the process during implementation, creates productive reports, which leads to better decision making and also highlights the functional capability of deployed information system. Finally, in post implementation phase, process mapping helps the company to identify process improvements, business performance and continuous organizational improvement in each process (see Figure 12, below).

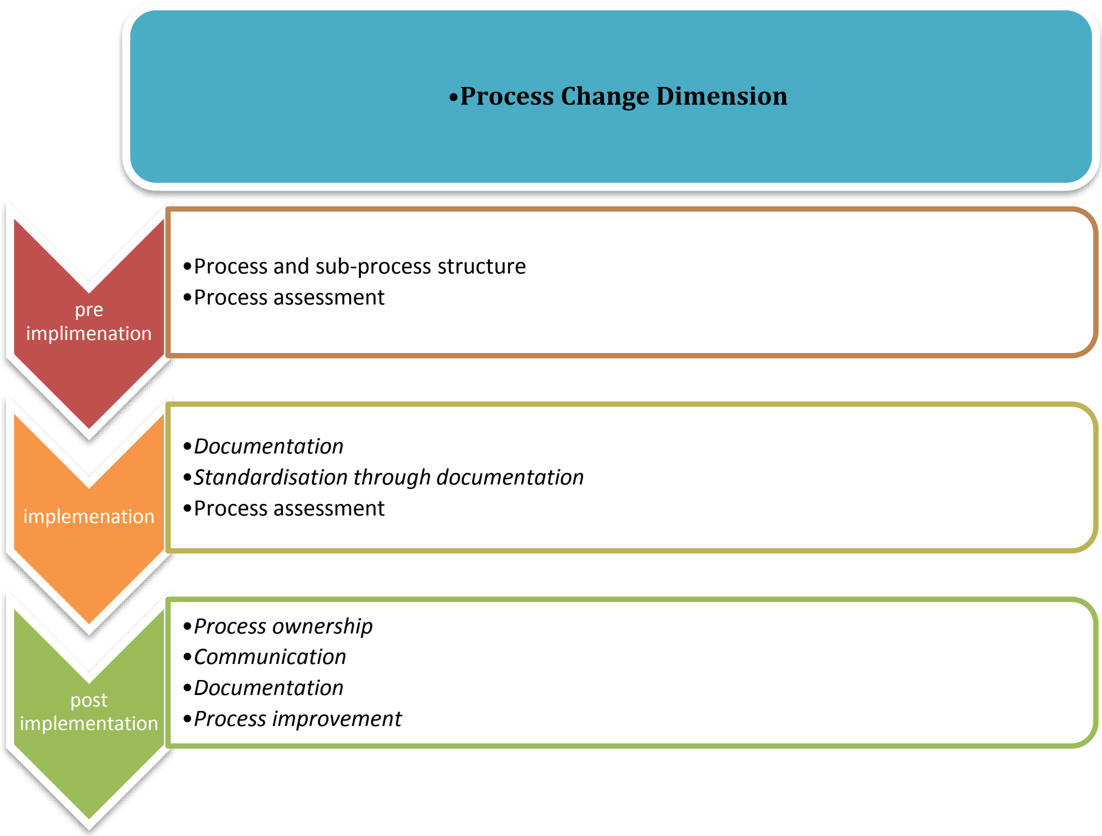


Figure 12: Process Change Dimension

3.2.3 The Change Elements

In order to assess the conceptual ERP implementation model developed in this research, successful factors need to be clarified. However, the success of ERP implementation can be seen from many viewpoints, in the context of this research, they depend on three variables of change: people, process, and technology. In this research each element of change defines different criteria to assess the success of ERP project in manufacturing SME's in Iran.

3.2.3.1 Technology Elements

Pre Implementation Phase

- ***IT Infrastructure***

Providing high quality IT infrastructure will increase the capability of an ERP system. Therefore, before implementing the ERP system, the company needs to identify the changes in IT infrastructure and provide sufficient budget for a high performance IT infrastructure.

- ***Information Reporting***

Prior to starting implementation of the ERP system, the project team should identify the required reports, which is useful in determining the kind of report needed and who would be best to generate it.

- ***Package and Module Selection***

Modules to be implemented in ERP system will need to be selected based on current company operation. Data would need to be moved from existing system to the new system being implemented, the business analyst and system architect would have to analyse existing data and decide how to transfer existing data. They would also need to map existing data into database tables in new system.

- ***Data Conversion***

The company would need to convert its existing data to the new system, at the same time identifying the required data based on selected ERP solution. Software providers can provide the program to convert the data to appropriate format.

- ***Customisation***

There are often three levels of customisation. Firstly, there is personalization, which refers to the look and feel such as colour, font, background, logos, screen, and dashboard layout. The second is configuration, which covers options for process flow, data flow, calculation and data fields that the system provides, but do not require any changes in the program code. The final one is customisation, related to bespoke changes required by the client to changes in the program code.

Implementation Phase

- ***ERP Modules Deployment***

Knowing when and where deploy ERP modules, and make changes in the business process is hard and depends on the company goals and objectives. Once the ERP modules have been selected, the company can decide the order in which various module need to be deployed. Data migration will take place during the module deployment by special software, designed by the software provider.

- ***Implementation Process***

The success and benefits of ERP is largely determined before the implementation phase. Having said that, it does not end at go-live either, and the experience after the system is implemented, may derail the success of the system. ERP implementation is complex, and takes time, money and resources; therefore, it is unrealistic to expect to finish implementation hastily. There is no need to implement everything at once; phased implementation is typically less risky.

- ***System Ownership***

Whilst implementing the ERP system, it is essential to know who the system owner is. The system owner is responsible for the new system, monitors and leads the system upgrade, change or maintenance.

- ***<u>Critical Technology Issues</u>***

Reviewing and testing hardware, security alongside providing technical support is essential for implementation success.

Post Implementation Phase

- ***<u>Upgrade and Maintenance</u>***

The need to upgrade the system increases, when the company identifies opportunities to improve or modify business processes. It is of utmost important for the organisation to upgrade and maintain the system regularly.

- ***<u>Data Accuracy</u>***

After data migration into new system, they should be reviewed for accuracy and precision, as inputted data will drive the new process and system.

3.2.3.2 People Elements

Pre Implementation Phase

- ***<u>IT and Computer literacy</u>***

Level of IT skills, computer literacy and also knowledge of ERP has a direct impact on any ERP project. Since employees are the main users of the system, it is essential to know who is going to use the system and how good their IT skills are. This will help to understand what training employees will need.

- ***<u>Awareness of Goals and ERP Project</u>***

Involving staff with company goals, objectives, and expectations and the role of new system in all stages is essential in ERP success. Awareness of the importance of the project and how it impacts an employee's day-to-day activity will reduce the resistance and encourage employees to support the project. In addition, involving key users in workshops to verify process flow details and establish current and future information needs has a positive effect on ERP implementation success and facilitates the implementation process.

- ***Selection of Main users, and System Champions***

Identifying the main users and system champion is essential in an ERP implementation life cycle. Sometimes failure comes from operational issues; therefore, it is important to select the users that have very good charisma and persuasive character to impact on other employees. In order to accomplish a successful project, the project needs someone to not only supervise the technological aspects of the project, but also be experienced and qualified with effective character and personality to encourage end users to accept the new system. The system champion should have impact on employees to manage user's resistance and encourage adoption. The system owner should also be able to identifying who is going to use the system and where and when will they use the system.

- ***Appointment of Project Board, Project Team Members***

At the first project meeting, company needs to set up a project board and project team. The project board should include directors, and top management to support the project, be involved in software implementation decision, commit resources and communicate with the implementation team. The project team should include project manager, IT representative, process owners, user representative, and software supplier. The project team is also responsible for controlling and managing the actual implementation life cycle.

Implementation Phase

- ***System Users (system administrator, system champions)***

Adopting new technology leads to new role and responsibilities. Organisations need to identify changes to roles, responsibility and skills. Identifying key participant, system admin and system champion for new system accelerates the ERP project. All employees should be clear about their job and responsibilities, the way they have to complete the task and use the new system.

- ***Training and Staff Development***

Focusing on business processes and the user's role rather than transactional training will increase the likelihood of ERP success. Furthermore, it is more convenient to start the training before ERP implementation to prepare and enhance the confidence of users to use the system during implementation and support the project team.

- ***Effective Project Management***

Project team needs a capable project manager to plan, lead and manage the ERP project. Project manager should have experience and sufficient knowledge in ERP project management as lack of experienced project managers has been identified as one of the critical failure factors in ERP projects in Iran.

Post Implementation Phase

- ***User Satisfaction***

Another effective parameter to consider in ERP success is user satisfaction. Organisations can assess this parameter by conducting a survey for all users. The more the users feel comfortable and satisfied with the new system, the better the performance and results derived from the system.

- ***Follow up Training in Case of Upgrade***

After implementation it is necessary to provide training for new staff or all staff after upgrading the system, as this will enable users to acquire necessary knowledge to use and support the system.

3.2.2.3 Process Elements

Pre Implementation Phase

- ***Process and Sub-Process Structure***

Will your business processes change with ERP/ IS?

Identify company main business processes and document the current company business processes. Vandaie (2008) asserted that a successful implementation requires mapping current business processes and defining new processes that align with the new system and business needs. Process mapping techniques gives a better understanding of main business processes and generates ideas for process improvement as well as profiling existing information systems in key process areas. This will also help to define 'TO BE' processes before selecting software. Process mapping, identifies problems, look for immediate time savings, identify metrics, and consider 'what if' scenarios and how processes interact will improve processes.

- ***Process Assessment***

It is essential to identify the processes that need to be changed before starting an ERP project. The findings of process mapping will be used as the basis for identifying the key improvements that new systems could deliver. Using a red-amber-green analysis, the strategic soundness and functionality capabilities of existing systems would be evaluated in each process area. Not only will this help to identify processes to be changed, but it will also help to identify the new process.

Implementation Phase

- ***Documentation***

Process documentation can be done through text, flowchart, and swim lane diagram to present a process. Documentation shows exactly how a process works, and the relationship between each activity. In other words, documentation process gives a detailed instruction of each process and the logic for the embedded process and sub processes in ERP module. Understanding the processes and sub-processes and the logic behind them, will simplify training, levels of learning and increase the acceptance of new processes. Documentation also helps to identify problems that may exist in the new system and decrease user resistance. Detailed documentation of the new processes will also assist users to overcome the tendency of using pervious routine and avoid the creation of *ad hoc* methods.

- ***Standardisation***

Proper documentation of defined processes and sub-processes will enable the organisation to set standards that must be followed by users across the organisation for each process and sub-process. This enables consistency across the organisation should the activity be carried out by more than one person or in different locations.

For example, for an inventory process in a bus manufacturing company, the organisation may decide to set a minimum stock quantity of ten tires and as such should an order need to be placed, the amount to be purchased would be minimum stock quantity minus available stock plus order amount. Therefore, organisations need to set standard for purchase bases on their sales order. One of the benefits of ERP system implementation is the standardisation that system imposes into business processes (Keller and Teufel, 1998).

- ***Process Change***

It is essential to identify the processes that need to be changed before starting an ERP project. The findings of process mapping will be used as the basis for identifying the key improvements that new systems could deliver. Using a red-amber-green analysis, the strategic soundness and functionality capabilities of existing systems would be evaluated in each process area. Not only will this help identify processes of change, but it will also help to identify the new process.

Post Implementation Phase

- ***Process Ownership***

Identifying who is the owner of the process, facilitates ERP implementation and affects other major roles. The process owner defines controls, manages, improves and analyses the process. Process owner should be an expert in the process and be able to effectively communicate defined processes and standards with employee.

- ***Communication***

Once a company has defined, articulated and endorsed the processes and standards, they should communicate explicitly well with their employees and clarify its benefits. They should also make time to explain the essence of the change to the affected staff. The organisation is responsible to clearly communicate who the project sponsor is, alongside providing on going communication mechanism during the project. Al- Mashari and Zairi (2000) asserted that continues and effective communication among top management and main users reduce the user's resistance. Al- Mashari, Al-Mudimigh, and Zairi (2003) asserted that communication could build the competence of the whole organization in re-engineering efforts, and gain everyone's commitment, support and response.

- ***Documentation***

At this stage existing processes documentation could be reviewed and modified to cater for adjustments that may have been made during the ERP implementation. In addition, issues encountered while using the new processes should be documented and reviewed for better performance.

- ***Process Improvement***

In this research the level of process improvement is based on the level of changes in business processes and how effective were those changes to meet business needs, goals or objectives. Manufacture higher quality product, increased production, reduces production costs and many other are examples of goals.

3.3 Summary

This chapter proposed a conceptual model for studying the implementation of ERP systems in discrete manufacturing SMEs in Iran. The model is based on three main dimensions of change proposed by Heeks (2002) and related elements of change. The model includes the key factors influencing ERP projects in three implementation phases. The model stresses the importance of balancing technology change with appropriate parallel change in process improvement and people skills. The presented conceptual model will help the researcher with questionnaire design and enable a better understanding of ERP implementation success in three manufacturing SME’s in Iran. The next chapter presents the research methodology and the approach of the study for data collection and data analysis.

Chapter 4: Research Methodology

4.1 Introduction

Sarantakos (2005) defined methodology as a series of methods and logical arguments used by the researcher related to the research subjects and which help the researcher to answer research questions by developing a research framework in a particular context. This chapter provides in-depth explanation of the adopted research methodology and how the research was conducted and progressed to achieve the objectives of this study. The research used a case study method involving three discrete manufacturing SMEs in Iran. The detailed questionnaire and interview questions were designed based on the proposed conceptual model and completed with employees who had been involved in IS/ERP implementation in all three case studies.

The chapter begins with a brief introduction, followed with discussion of the research paradigm and purpose, research approaches and methods, and research strategy. The research design and research questions and aims are discussed, followed by a review of relevant theories and techniques regarding methodology, data collection and data analysis. The process of research design and data gathering within the research is also discussed. Finally, the chapter reviews the strengths and limitations of the methodology and also ethical issues associated with data collection.

4.2 Research Purpose

Saunders *et al*. (2012) defined the three main purposes of research activity as exploratory, explanatory, and descriptive purposes. An exploratory study attempts to gain new knowledge and insights related to the research topic. This kind of research helps the researcher to discover what is happening, and also clarify and understand the nature of a problem. Searching literature, interviewing experts in the subject, in-depth individual interviews or focus group are some of the ways motioned by Saunders as suitable to conduct exploratory research. Exploratory study is flexible and adaptable to change, which is an advantage for the researcher if she is willing to change direction as a result of finding new data and insights (Saunders *et al*., 2012). According to the above arguments, this study is exploratory as it attempted to explore and gain insights regarding information system adoption in discrete manufacturing SMEs in Iran.

4.3 Research Philosophy

Saunders, Lewis and Thornhill (2012) defined research philosophy or research strategy as an indication of how a researcher will answer the research questions. The correct choice of research strategies, which is directly rooted in the research questions and objectives, enables the researcher to achieve a reasonable level of coherence throughout the research design and also to answer research questions and meet the research objectives (Saunders *et al*., 2012). Researchers use different data collection techniques based on the research undertaken, this should be adopted based on the different research purpose (Saunders *et al*., 2012).

Before conducting a research project, it is important to determine the philosophy that will be adopted in the research. Research philosophy is grounded in a specific paradigm. Paradigms are theories concerning how different communities have different viewpoints about how to do the research, which stem from different philosophical perspectives. Oates (2006) defined a paradigm as a pattern or shared way of thinking. He stated that all research is based on underlying paradigms.

This section discusses the relevant paradigms and their relationship with philosophical aspects such as ontology, epistemology, and methodology. According to Guba and Lincoln (2005), ontology refers to the nature of reality and how we can understand that reality. Epistemology is the researcher's view of how his/her knowledge about reality is generated. Methodology refers to the procedure and logical steps researchers need to follow or consider for collecting valid data, based on the research purpose and the research philosophy deemed most appropriate for this purpose.

Creswell and Clark (2011) described positivism, post-positivism, interpretivism, and pragmatism as four possible philosophic assumptions (paradigms) that can be adopted in a research proposal. In relation to the definition of paradigms, an interpretivist paradigm was seen as the most appropriate theoretical structure, which is appropriate to this research to achieve the objectives of the research study and answer the research questions. An interpretivist approach relies on multiple realities and is associated with qualitative research (Williamson, 2000). In this approach, Williamson suggests reality is to be considered subjective, consisting of a synthesis of multiple perspectives and therefore socially constructed. For that reason, the ontological assumption in this approach means that reality is relative to the researcher and his or her co-creation of meaning with the research participants, and there is no objective reality, and the epistemological position is that the researcher and the object of research are interlocked. A principal stance within interpretivism is understanding and reconstruction of knowledge. Findings are thus created by the researcher's interpretation and by the investigation process. This philosophical position was adopted because the challenge of implementing an ERP system in manufacturing SMEs is a practical matter involving the work of numerous individuals over an indeterminate but discrete time period, and the aim of this study is to develop a comprehensive framework of successful ERP systems implementation in discrete manufacturing SMEs in Iran. A quantitative approach using a positivist philosophical position would only have allowed the researcher to investigate the relationships between critical change elements derived from the literature, reducing the depth of the research and leaving it open to the possibility that understandings of IS implementation produced in developed countries were being imposed on a developing country context. As a researcher conducting an exploratory study, it was more important to discover the decisions and actions taken by key personnel at the case study organizations, and the effects these decisions and actions had over time, with the benefit of retrospection. This enabled the research to investigate the nature of ERP implementation, encompassing issues of 'how' and 'why' certain things happened and what their effects were. This depth of knowledge was only available through an exploratory study taking an interpretivist philosophical position and a qualitative approach.

An interpretive philosophy also allows in-depth qualitative methods and data collection techniques investigating small samples. Qualitative methods are seen as appropriate for this research, which seeks to explore situations of IS implementation in discrete manufacturing SMEs in Iran, create a conceptual framework for analysis, and identify success and failure factors. The first two research questions seek to identify the factors regarding IS adoption in Iranian SMEs: to evaluate what has worked and what has not, as well as discovering the underlying problems that discrete manufacturing SMEs are faced with during the implementation phase, with regard to the system and implementation method they have adopted.

According to Saunders *et al*. (2012), case study is a research strategy exploring a research topic within its context. Case study methods enable the researcher to gain in-depth knowledge of the context of the research. Case studies are often used in exploratory and explanatory research. Surveys, questionnaires, in-depth interviews, and documentary evidence are techniques that can be used to collect and analyse data. Yin (2012) categorises case study research into single or multiple case studies.

It can be said that this method is appropriate for IS research, since case study can answer HOW and WHY questions and help the researcher to understand IS processes and also experience a real environment, learn about it and generate theories from practice (Benbasat Goldstein & Mead, 1987). Huang and Palvia (2001) mentioned that each country has national differences, such as language, culture, law and regulations etc. that affect the way businesses operate, so it is important to study IS in their organisational settings (Orlikowski, 2000).

This study used multiple case studies to identify and investigate critical success factors in the ERP implementation process in a real socio-economic context (discrete manufacturing SMEs in Iran) and to propose a new model for IS/ERP implementation in such organisations. Consequently, this research study can logically be labelled as interpretive as the social reality of this research focuses on the details of situations and realities of IS/ERP implementation in manufacturing SMEs in Iran. The context of this research, along with the research objectives and questions, helped to identify and define the appropriate research methodology.

4.4 Research Methodology

According to Silverman (2010), research methodology refers to the way that researchers gain knowledge within the project undertaken. The three main methodological approaches are quantitative, qualitative, and mixed method research (Tashakkori and Teddlie, 2003). A quantitative approach can examine phenomena (objects and relationships) under study (Cornford and Smithson, 2006), and is often associated with a positivist method. On the other hand, a qualitative research approach describes situations and outcomes, which may use, for example, grounded theory, case study, ethnography, or action research.

Although case study was the research approach finally adopted, other methodologies were considered, in particular, action research. Bradbury (2015) identifies action research as a collaborative and participatory research process wherein those traditionally regarded as the ‘objects’ of research are instead perceived as co-creators, not just of knowledge, but of the conclusions that that knowledge leads to. As such, it is perhaps the most democratic and consultative research approach and requires researchers to consider ethical and evaluative issues not implicit in traditional research. Initially, action research offered some advantages to a study of this kind; for example, by co-opting participants in the creation of meaning the researcher is able to offer a research outcome likely to be of use to its participants, which is an attraction for companies investing significant sums of money in IS systems. However, certain characteristics of this study made action research unviable. The researcher was not able to travel often enough to Iran to conduct the research in person, diluting the extent to which the research participants were able to feel personally involved in the data analysis process as well as data collection. Moreover, the research process of three concurrent case studies allowed for the different phases of data collection (survey, questionnaire, interviews, documentary evidence) to inform each other through researcher reflexivity. However, this was not possible with the participants from the companies involved in the case studies for a number of reasons: firstly, as potential competitors at least two of the companies would have been unwilling to share information with each other. Secondly, the geographical distance of the researcher from the research subjects made interactive research unfeasible. Finally, the production of the IS Implementation Model in Manufacturing SMEs in Iran (see figure 45) involved an extra stage of analysis involving synthesis of the findings of the three case studies, and it would not have been possible for participants from each case study company to contribute to this process while maintaining the level of confidentiality promised by the researcher during data collection.

Qualitative research is often connected to an interpretivist philosophy as the researcher seeks to make sense of subjective and socially constructed meaning expressed about the phenomenon being studied and also gain an in-depth understanding. In this method, researchers are looking for meanings and relationships between them, using a variety of data collection techniques to develop a conceptual framework (Saunders *et al*., 2012).

Creswell (2003) emphasised that selecting the right research approach is an essential decision concerning the design of the research project. Saunders *et al*. (2012) contended that a research project involves the use of theory, which may or may not be made clear in the research design. According to Saunders, clarity regarding theory at the beginning of the research gives the researcher the opportunity to select an appropriate design for the project. Furthermore, Saunders represented this as three approaches based on the reasons for undertaking the research: Inductive, Deductive, and Abductive.

The deductive approach occurs in a study in which the premises are true and therefore the conclusion, which is derived logically from those premises, must also be true. In contrast to the deductive approach, in an inductive approach the conclusion reached, based on the premises used, has a less logical connection and therefore can only be judged to be supported by the premise. According to Saunders *et al*. (2012, p. 106) in an inductive approach "known premises are used to generate untested conclusion…. Generalising from the specific to the general… Data collection is used to explore a phenomenon, identify themes and pattern and create a conceptual framework, thereby generating and building theory".

The interpretive philosophy adopted in this research study helped the researcher to understand fundamental principles regarding what was going on and what was the nature of the problem of ERP implementation in SMEs in the discrete manufacturing SMEs in Iran. Results used to formulate and develop a framework for implementation of ERP in discrete manufacturing SMEs in Iran. Based on the Inductive approach adopted in this research project, a variety of qualitative methods used to collect data in order to establish different views of phenomena (such as qualitative questionnaires, interviews, and documentary evidence). Participants at several discrete manufacturing SMEs in Iran who have adopted IS were questioned and interviewed to understand their IS situation, their experiences, how they coped with problems they experienced, and their view about possible cause of failure or success in implementation. Furthermore, the provisional conceptual framework was developed on the basis of literature reviews and existing models, in order to advance their conclusions further in light of the research findings.

Exploratory research emphasises studying a situation or a problem to explain relationships between variables. The next stage of the research involved sending exploratory questionnaires to personnel who had been directly responsible for implementing IS/ ERP in three discrete manufacturing SMEs in Iran to indicate the nature of IT implementation, what systems have been used and what degree of success has been achieved. The questionnaire also helped the researcher to gauge the feasibility of implementing ERP systems in Iranian SMEs. As a final point, this study is a classic case study using qualitative methods such as survey, questionnaire, in depth interview, and documentary evidence to collect required data.

4.5 The Research Design

The way a researcher conducts and plans the research can be referred to as the research design. According to Yin (2013, p. 58) research design is the “logical plan for getting from here to there”. He also identified “here” as initial research questions to be answered and “there” as some set of conclusions that are arrived at as a result of answering the questions. Research design helps the researcher to avoid the situation in which the evidence does not address the initial research questions (Yin, 2013).

This project design is based on eight phases as depicted in Figure 14: literature review (Chapter 2), developing a provisional conceptual framework (Chapter 3), case study selection, data collection (developing survey, questionnaire, interview) data analysis, and developing a new model for ERP implementation in discrete manufacturing SMEs in Iran (see figure 13, below)

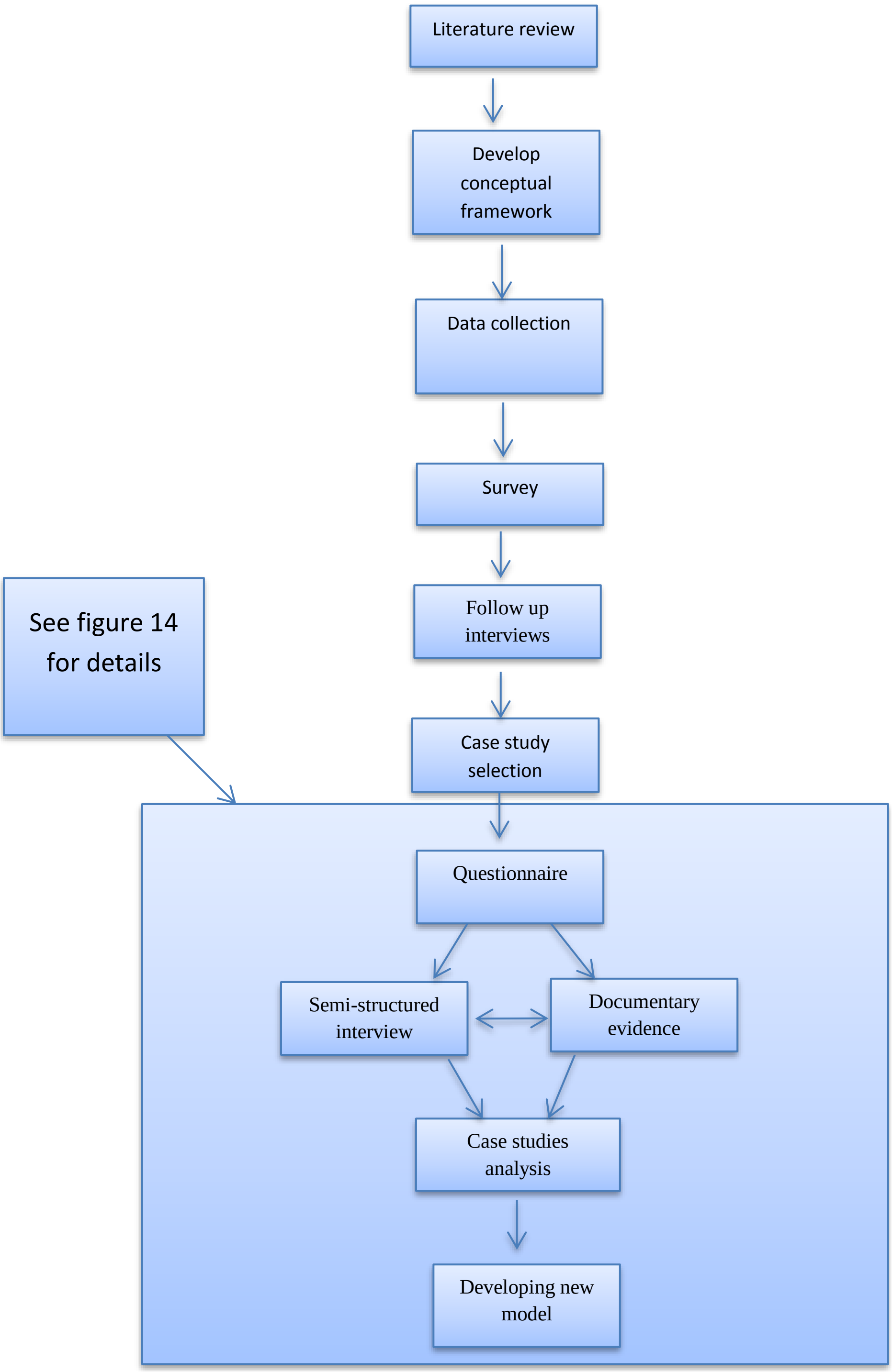


Figure 13: Research Design

Within the flow-chart model above (figure 13) the process of data collection and data analysis was a complicated and concurrent process, therefore a more detailed depiction of this process is offered in figure 14 below. In particular, this figure seeks to describe the stages of data collection, how each stage informed the one subsequent to it and how these iterations were adapted somewhat within each case study. In moving through stages of data collection and analysis, the researcher remained mindful of the research aim to explore the nature of ERP implementation, which required an open approach to data and a willingness to allow participants to reflect on their decisions and actions and consider how these led to outcomes and results. In this regard, the several stages of data collection were useful to both the researcher and participants: for example, the researcher was able to reflect on questionnaire answers and identify areas to be explored in more depth, while the participants had more time to discern the intentions of the researcher and contemplate their own processes as a part of their organizations' implementation.

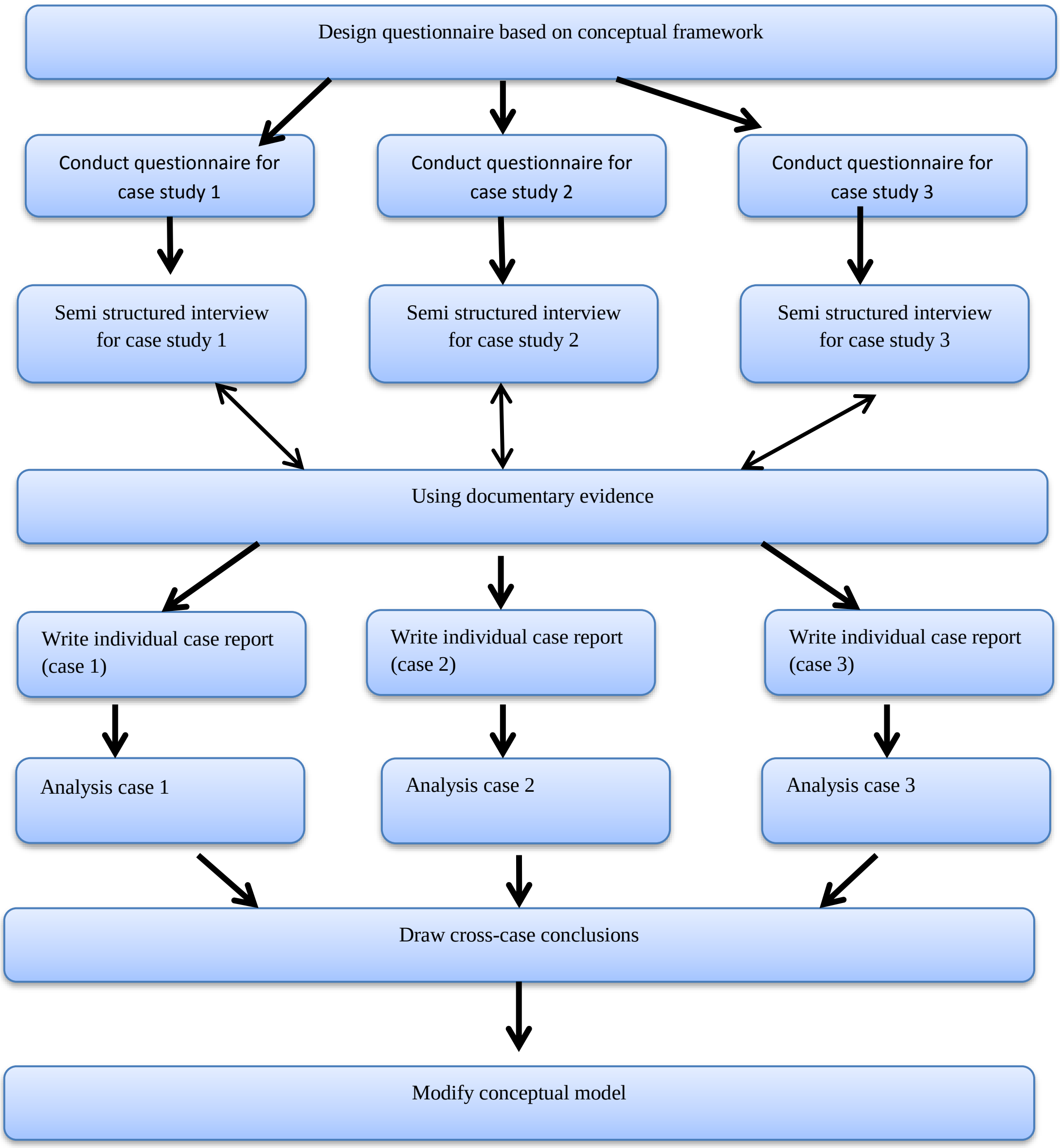


Figure 14: Detailed data collection

Figure 14 attempts to explain the processes included at the bottom of figure 13 in more detail. Of particular importance is the relationship between the three main stages of data collection and how they related to each other, and to the process of data analysis. The survey was a intended to address RQ1 on the extent of ERP adoption among manufacturing SMEs in Iran, and in particular it served two important functions: firstly, it used two open ended questions to allow the responding companies to give as much information about their IS systems as possible. Secondly, it asked companies that responded to say whether they would be willing to participate further in the study. This allowed the researcher to identify three companies that were capable of producing rich data on ERP adoption in Iran. Following the survey, the three cases selected were sent the questionnaire, which was divided into sections covering the three phases of implementation and the three dimensions of change. In each case, the questionnaire was distributed to several members of staff involved in ERP implementation processes who all completed a copy and returned. Following the collection of the questionnaires, the researcher did not undertake full analysis of the data; however, she familiarised herself with the responses and took time to reflect on them in order to frame follow-up questions to be asked in the interview process of data collection. Thus, the semi-structured interviews conducted with each case were slightly different; however, they were the same for each participant in each case study.

This study conducted a literature review to understand some of the key concepts related to ERP implementation in developing countries. This guided the researcher in conducting research and constructing data collection techniques. A conceptual framework was developed based on the in-depth literature review and analysis of previous models to guide the researcher in developing a theoretical framework later in the study.

4.5.1 Case Study Design

The case study is a widely used research method within business research. Bryman (2011) argues that the case study is particularly appropriate to be used in combination with a qualitative research method, allowing detailed and intensive research activity, usually in combination with an inductive approach as regards the relationship between theory and research. The case study is also appropriate for a combination of qualitative methods, which is of particular relevance to this study of information systems in three SMEs, where systems mapping and profiling techniques were included within the questionnaire and interview approach. Saunders *et al.* (2009) argue that case studies are of particular value for explanatory or exploratory investigation, such as that pursued in this research. Furthermore, Yin (2013) asserted findings from multiple cases studies are more reliable and vigorous than a single case.

Yin (2013) identifies studies that employ multiple cases as comprising three steps:

1. Define and design: At this stage the theory is developed, then a researcher moves on to select the cases and design the data collection.

2. Prepare, collect, analysis: In this step, the researcher conducts each case study and prepares an individual report for each.

3. Analysis and conclusion: In this stage, the researcher draws a conclusion based on individual findings from each case study to modify theory and develop strategy, which helps in writing a cross-case report (see chapter 7).

The need for a case study arises from the quest to understand, analyse and highlight a complex phenomenon - for example, strategic developments or processes such as IS strategy studies. The primary purpose for undertaking a case study in this research was to explore the details of ERP implementation in discrete manufacturing SMEs in Iran. The goal for the researcher was to design a good case study and to collect, present and analyse data as objectively as possible. Case studies are often used to provide insights into a significant managerial issue, providing an analysis of the context and processes that illustrate the models and concepts being researched. They will often study a decision-making process, examining why decisions were taken, how they were implemented and what the results were. Data collection and analysis methods are secondary technical dimensions of case studies. It is a matter of investigating an empirical topic by following a set of specific procedures to gain appropriate valuable information and ideas (Yin, 2012).

Multiple case studies have been adopted in this research to gain an in-depth understanding of information system processes and design in manufacturing SMEs in Iran. Successful IS implementation in discrete manufacturing SMEs in Iran is the main concern. Therefore, this study focused on developing a comprehensive implementation method in selected cases in Iran. In this research, three discrete manufacturing SMEs were chosen based on the following criteria:

1- Company nature
2- Company size

3- Company location
4- Company information system

The research focused on Isfahan and Tehran province as the two main industrial zones in Iran. Selecting two locations helped the researcher to widen and generalise research findings. The case study companies have been assigned aliases to ensure confidentiality. The first case study is the Isfahan Bus Company (IBC), which was founded in 1985 as a family business in Najafabad in Isfahan province. The company designs, manufactures and sells a range of buses, vans and spare parts and currently employs 350 staff. The second case study is Electronic Transmission Systems (ETS), a company employing 160 staff, which was founded in 1978, and is another family business in the Isfahan province. The company designs, manufactures and distributes electronic vehicles, E-bikes, differential transmission systems (for companies such as Pride, Nissan Jounior and Tiba engines), and pinion and gear differential systems and parts. The third case, which was founded in 1988, is a Spare Part Company (SPC) manufacturer of parts for commercial vehicles (trucks, buses, minibuses & vans). SPC operate as a private business in Tehran province and currently employs 250 staff.

4.5.2 Data Collection

Data collection refers to series of activities designed to gather data to answer research questions (Creswell, 2007). Sampling, collecting data, recording the data and administrating the data collection are the key components in data collection procedure in research methods (Creswell *et al.*, 2011).

In order to test the practically of the proposed conceptual framework set out in chapter 3, multiple case studies were employed to focus on three discrete manufacturing SMEs which had adopted an IS/ERP system. This study initially used a survey questionnaire, sent to 75 manufacturing companies, of which 50 responded. This survey identified companies that had introduced ERP systems and were willing to be contacted, which allowed the researcher to make some initial phone conversations, which helped her to answer the first research question concerning the extent of ERP systems implementation. This stage was followed by the choice of the three cases study companies, based on the criteria explained in 4.5.1 above.

These companies were sent a detailed questionnaire (see appendix 1), with a request that as many individuals involved with the companies' ERP implementation processes as possible responded. For Case Study 1 (IBC) three people responded. In Case Study 2 (ETS) it was two persons, while in Case Study 3 (SPC) five persons responded. Following a period of reflection and consideration of this data, but before full data analysis was conducted, the researcher identified areas on which she wanted more information for each case study, which lead to the follow-up semi-structured interviews conducted with each detailed questionnaire respondent at each case study, making ten interviews. As an example of the relationship between the detailed questionnaire responses and the interviews, the researcher found that the first questionnaire question on process mapping often left a lot of details unexplained or lacked specifics on what the companies actually did about issues such as training. Therefore, the semi-structured interviews allowed for deeper exploration of these issues to facilitate comparison of the cases. The resulting data for the detailed questionnaire and follow-up interviews were combined with analysis of company documents on IS or ERP projects within the selected case studies, as research sources (see Table 9, below). Data collection was therefore achieved through literature review, survey questionnaire, detailed questionnaires, and follow-up semi-structured interviews. Yin (2012) suggests that the utilisation of multiple sources of evidence is one way of increasing the construct validity of case studies.

Research Questions	Research Objectives	Methods
What is the extent of ERP systems implementation in Iranian SMEs?	To analyse and evaluate the current situations of IT and IS applications in general and existing ERP applications in particular in Iran.	Literature review, questionnaire survey, follow-up phone conversations
What has been the nature of ERP implementation in Iranian SMEs? Have the change dimensions of technology deployment, process improvement and people skills enhancement been in balance? What have been the critical change elements or factors?	To investigate and assess how ERP systems have been implemented and how successful these projects have been.	Detailed questionnaire, semi-structured interviews, documentary evidence
What new framework can be developed for Iranian SMEs to adopt and implement ERP systems to improve their business performance?	To analyse and evaluate how ERP systems have been implemented and to propose and develop a new framework for ERP system adoption and implementation for SMEs in Iran.	Survey questionnaire, detailed questionnaire, semi-structured interviews, documentary evidence

Table 9: Chosen Research Method based on Research Questions and Objective

4.5.2.1 Sampling

According to Yin (2013), sampling enables the researcher to reduce the amount of data required to collect by studying a few samples rather than all possible cases, and also the results of the study can be generalized to other cases of the same class. He classified them into probability and non-probability sampling. In probability sampling, which is more suitable for quantitative work (Bailey, 2007), the researcher can select her/his sample randomly from the population and can generalise her/his conclusions to a wider population. With non-probability sampling, which is mostly used by field researchers on a small number of cases, the probability of selecting a case from the total is not known and selected cases do not represent a wider population; however, they have the information required to answer research questions. In this type of sampling, the researcher may be able to generalise about the population, but not on statistical grounds (Yin, 2013). This study used non-probability sampling techniques as one of the qualitative characteristics to select case studies in Iran.

4.5.2.2 Process Mapping

Information systems process mapping presents a sequence of maps that refer to activities involved in defining the functionalities of information systems based on business needs. Process mapping can provide an unblemished view of what the information systems does, and how the success of IS deployment can be determined. CPS Activity Based Costings Team (CPS, 2011, p. 3) describes process mapping as a method which "presents the different tasks within the process; it indicates the kind of decisions to be made; and it presents the strengths and weaknesses of the steps and presents to the researcher the interdependence of the different process steps on one another".

Before adopting information systems within an organisation, it is essential to review business process, business needs and current systems in the organization. Process mapping method allows organisations to understand their main business processes and generate ideas for process improvement as well as profiling existing system in key areas. Detailed flow charts for current business process should be mapped graphically to facilitate a better understanding of process and current document used.

To develop a process map, the mission and objective and goals of the company should be clarified. Akeel *et al.* (2013, p. 10) stated that a "process mapping system is used as a framework to identify the business processes; it is also used as a point of reference for improving or changing the business process". Wynn *et al.* (2009) asserted that process mapping evaluates the weaknesses of company information systems by examining what is missing in a current information systems and which functions should be added or replaced. Therefore, process mapping helps to establish what systems currently exist, and how they are performing, and also current and future information needs, which allow the project team to identify issues and information gaps in company.

This study used process mapping and systems profiling to assess the systems status of a company and its readiness for ERP project implementation. The design of the detailed questionnaire was to evaluate current systems in Iranian SMEs, making use of process mapping the system status of some case studies of Iranian discreet manufacturing SMEs to provide the necessary data for generalisation to ERP implementation among discreet manufacturing SMEs in developing countries.

4.5.2.3 Questionnaire Design

Questionnaire is one of the most widely used data collection methods within the survey strategy as information can be obtained by asking each person to respond to the same set of pre-determined questions (Saunders *et al*., 2012; Bryman, 2008). Designing a good questionnaire survey is a hard task; moreover, the accuracy of collected data depends on the precise design of the questions (Saunders *et al.*, 2012). The researcher should develop the questionnaire precisely to ensure the collected data is able to answer the research questions and to achieve the research objectives. Questionnaire design directly affects the rate of response and reliability and validity of the collected data (Saunders *et al*., 2012). Saunders *et al.* (2012) emphasise that the researcher will have just one opportunity to collect the data and he/she will not be able to go back to participants who choose to remain anonymous to collect more information or use another questionnaire. Therefore, the researcher should be careful how they design the questionnaire.

The study developed a structured questionnaire. The questionnaire was sent to appropriate respondents in each selected case study. The purpose of questionnaire in this study, along with instructions on how to complete it, was explained in a covering letter, which was attached to the questionnaire. The questionnaire was constructed based on the literature review and the conceptual framework, which were themselves developed based on analysis of previous models, to collect the required data to answer the first and second research questions.

The questionnaire was designed in English, but as Parsi is the official language in Iran, translating the questionnaire to Parsi was an essential requirement. The questionnaire was translated by the researcher and another certified translator to ensure that all questions were translated coherently and delivered the same meaning as the English version. English versions can be seen in Appendix 1. According to Saunders *et al.* (2012), to design a good questionnaire, each question should be designed carefully, with clear layout, and the purpose of questioners should be explained coherently. The questionnaire should pass the pilot test, and the delivery and return of the questionnaire should be planned and executed carefully. Therefore, the creation of clear questions, presented in the right order, and with the appropriate response format, will be explained in this study.

A detailed structured questionnaire was filled in by several respondents in each case study company, which allowed follow-up interviews to be conducted with the questionnaire respondents. More specifically, the topics included in the questionnaire (Appendix 1) can be categorised as follows:

a) Company general information:

b) Company information system and technology

c) People problems and challenges

d) Company's main business processes

Questionnaires and interviews were conducted in Parsi and the answers were translated into English.

Question Wording

The questionnaire was constructed precisely by designing simple and clear questions and providing clear guidance for each section. Each section includes open-ended questions to encourage the participant to explain if they needed to.

Constructing the Questions

The following survey questions and literature review (see Table 10, below) answered the first research question.

Q1: Survey Questions
Do you have any information systems in your company? (Please select)
☐A: ERP solution (such as SAP)
☐B: Total or integrated system (such as Behko)
☐C: Other information systems (either packages such as CRM or bespoke applications) (please specify)
☐D: No computerised solutions (i.e manual systems only)
If yes, would you be willing to fill in a questionnaire to give us further information that will be used in the research project?
☐Yes (please provide your contact details)
☐No

Table 10: Questions Guide to Answer First Research Question

The detailed questionnaire was designed based on three elements of change, which were discussed in chapter 3. The questionnaire comprises five sections (Appendix 1). The questionnaire was designed based on the defined three implementation phase discussed in chapter 3 and the defined elements of three main dimensions of change.

The first section started with simple and general questions about the company to find out the main objectives and business processes. The questions were about factors such as number of employees, nature of business, business objectives, age of the business, and so on. Moreover, the section included open-ended question to provide more details about the future business objectives. This clarified the processes and sub-processes that are central to the companies' business operations, and allowed a mapping of current technology deployment in each process area.

Section 2, 3, and 4 focused on the ERP/Total system project based on three dimension of change (Technology, People, and Process). Each section had three phases including pre-implementation phase, implementation phase, and post-implementation phase. The pre-implementation phase questions focused on company status before the start of the project in terms of the different dimensions of change. The implementation phase focused on the actual implementation process, considering a variety of change elements. The post-implementation phase focused on the status of the ERP project after implementation, to understand the level of project success.

In section two the questions focused on Technology change. This section covered communications, hardware, and e-business aspects to understand the company's level of technology adoption to assess the underpinning technical architecture, current systems status, and the functionality of the main information systems.

The questions in section three focused on people change. This section examined people skills and their readiness for change across the organization. Furthermore, it looked at the key problems or issues, from the point of view of the end user; integration and interfacing of systems, report quality, systems performance and general satisfaction levels in different departments that use the system.

In section four questions were more detailed to find out more about company information systems and method of communication in terms of how they worked, and also to assess the level of success in adopting information system in Iranian SMEs. This section attempted to identify the nature of each company's main business processes; it also investigated what information systems the company used, what they were used for and the capability of existing systems in supporting business processes. It included the use of standard packages (e.g. an accounts package like Sage for invoicing and ledgers) and also the use of spreadsheets or databases for any data recording and analysis (e.g. for staff records). It also included use of personal productivity tools, e.g. word-processors or graphics packages like Microsoft Word or Powerpoint.

The last section of the questionnaire provided options to respondent to provide additional information they thought might be relevant to this research.

Response Format and Layout of the Questionnaire

The researcher tried to keep the sections as short as possible to encourage the participants to answer the questions genuinely and then return it. Alongside with guidance on how to answer the questions, at the start of each section the reason why the researcher needed the participants to complete the section was explained clearly. Furthermore, the questionnaire ended by thanking the respondents and giving a concise explanation on what the researcher would do with the completed questionnaire.

Pilot Testing

Saunders *et al.* (2012) argued that before using the questionnaire to gather data it should be tested to ensure questions and directions are clear and able to answer research questions. Pilot test helps the researcher to refine the questions and avoid any problems in participants' responses and also make sure they understand questions clearly. The study carried out a pilot test to determine the precision and consistency of questions and identify potential problems may occurred for participants to answer the questions. The pilot questionnaire was given to several people who were not part of the research samples. They were asked to complete the questionnaire and comment on the questions and instructions given on the questionnaire.

Delivering and Collecting Questionnaires

After the questionnaire had been tested and refined, the questionnaire was sent via email to the sample companies to collect the required data. The cover letter stated a due date and asked the respondent to return it by the requested date.

4.5.2.4 Interview Design

Interviews have been highlighted as a most important source of case study evidence by many researchers (Yin, 2013; Bryman, 2003). Sarantakos (2005) defined an interview as a series of oral questions to gather required data for a research project. Because of the nature of exploratory research, interviews are likely to be relatively unstructured and to rely on the ability of the researcher to elicit high quality answers from the participants (Saunders *et al.*, 2012).
Interview have been categorised into structured, semi-structured, and unstructured by Saunders *et al*. (2012). In a structured interview, the researcher prepares a set of questions, based on research project, to ask in the same way and same order to each participant/s, which is exactly opposite to an unstructured interview. In unstructured interviews, which are more suitable for qualitative studies (especially case studies), there is no pre-set questions and researcher asks questions in any ordering based on the research project (Sarantakos, 2005). Semi-structured interview comes between those two interview types. In this type of interview, the researcher follows a list of questions, which can be vary from interview to interview and allow the possibility of follow-ups to attain more detailed information (Saunders et al., 2012).

In this study, semi-structured interviews were conducted through telephone calls to understand participants' experiences, perceptions and their feelings deeply, and also to collect in-depth and detailed information regarding IS deployment in the case study companies. Interview questions were designed based on the results of the detailed questionnaire, and interviewees were the same employees who had responded to the questionnaire; this helped the researcher to ensure that the findings from the questionnaire had accurately represented their views.

Interviewees

This section gives a short profile of each interviewee and discuss why they were selected. In all three cases the researcher urged the case study companies to select participants from the managerial level as they had more involvement in company ERP implementation projects.

- ***IBC Participants' Profiles:***

Company Head of IT (R1):

Company Head of IT, 35 years old who graduated in computer science. He had worked for this company since 2007 and had a key role in company ERP project.

Company Head of Commercial (R2):

Company Head of Commercial was 45 years old and graduated in business management. He started work as sales manager in IBC in 2000, and was then promoted to Commercial manger since 2006.

Company Head of Quality:

The Head of quality was a 38 year old engineer who graduated from management school, and had 10 years' experience as a quality control manager.

- ***ETS Participant's Profile***:

Company Head of IT(R1):

A 28-year-old company Head of IT who had been working in this company since mid-2013. He was assisting ERP project.

Company Head of HR (R2):

The company Head of HR had been working for this company since he was 24, which was long enough to know all company processes.

- ***SPC Participant's Profile:***

Company Head of Quality Control (R1):

The Head of Quality Control was 30 years old with a certificate in management field and had been in this company since 2014. However, he was not involved in the ERP project, but company director suggested him as one of the main users who was very familiar with the system.

Company Head of Finance (R2):

Head of Finance was 59 years old, who graduated from financial and accounting institute. He started working in this company in 2000.

Company Head of IT (R3):

The Head of IT was 49 and graduated as a computer engineer before starting work as IT assistant in 2003 and promoted to IT manger since 2009.

Company Head of Sales and Marketing (R4):

A 35-year-old sales and marketing manager has been with this company since 2011.

Company Head of Production (R5):

The company Head of Production was 58 years old who had been with this company since it started.

4.5.3 Data Analysis

Bailey (2007) asserted that analysing the qualitative data refers to the process of breaking down and interpreting the findings to highlight the results and meet research objectives. Pattern matching, explanation building, time series analysis, logic models, the use of chronologies and cross case synthesis are some of the analytic techniques for case study analysis (Yin, 2013).

The analysis of case study research has been subject to criticism that it is one of the least developed aspects of doing case studies, as many researchers start case studies without having an analytical approach or notion about how the evidence is to be analysed (Yin, 2013). Yin believes that using only tools will not produce the needed analytical result. However, he mentioned that “tools are important and can be useful, but they are usually most helpful if researchers have an overall analytical strategy” (Yin, 2013, p. 54). The strategy adopted should follow the original research questions and support the conclusion.

4.5.3.1 Chronologies

Yin (2013) observes that one of the advantages of case studies is that they “allow you to trace events over time” (p. 148). In this study, the cases were conducted to investigate how ERP implementation happened in discrete Iranian manufacturing SMEs and to evaluate the success of these projects. The process of evaluation therefore necessarily involves a chronological overview of the process of implementation, and this was achieved conceptually by the division of the process into three phases (Parr and Shanks, 2000). As a result, the data analysis process was informed by a consideration of **when** events in an implementation happened (in order to assign them to one of the phases), as well as **what** dimension the event had an effect upon (in order to categorise it into one of the change dimensions). The researcher recognised that for SMEs, it is important for them to know the factors that influence successful implementation, but also to know the time sequence within which these factors become important and their relative importance within their dimensions of change. Therefore, the chronological data analysis in this study was guided by Yin’s observation that establishing a chronology can “have an important analytic purpose – to investigate presumed causal events – because the basic sequence of a cause and its effect cannot be temporally inverted” (p. 148) and attempted to identify factors affecting ERP implementation and then categorise them temporally (into phases) and conceptually (into the dimensions of change). Thus, as Yin states, “the analytic goal is to compare the chronology with that predicted by some explanatory theory” (p. 148), in this case the explanatory theory was the conceptual model developed out of the literature review and the many previous models that have considered IS adoption chronologically (e.g. Heeks, 2000).

In all three cases a survey, phone conversations, detailed questionnaire, and follow-up in-depth interviews and documentary evidence were used and the findings analysed as qualitative data. This helped the researcher to understand the business process and organisational context and to develop an ERP implementation model for discrete manufacturing SMEs in Iran.

The data analyses was based on information gathered from four different stages of data collection, which will now be discussed in the order in which they took place. At each stage of data analysis the discussion centred on the three ERP implementation phases and associated elements of change listed within the conceptual model (see Figure 9, Chapter 3). Moreover, at each stage of implementation, elements of change were categorised into the Technology, People and Process dimensions. For the purposes of this research, ERP implementation was divided into the following three phases, as outlined in the conceptual model:

• Pre-Implementation Phase: to prepare, select and plan the implementation requirements
• Implementation Phase: to complete the implementation and Go live
• Post-Implementation Phase: to maintain, support and upgrade the ERP system

According to the findings of the literature review, it is imperative for the success of ERP implementation that all three change dimensions are implemented in each phase.

The stages of data collection and the associated data analysis, in the sequence they were conducted, was as follows:

Stage 1 – Survey. At this stage the concern was to answer Research Question 1 and the data were analysed using an Excel sheet, to identify responding companies that had implemented IS systems and to cross-reference with those willing to be contacted (see appendix 1, Survey Questions). Following this analysis, the researcher attempted to contact companies that fulfilled both initial criteria and was able to contact 10 companies.

Stage 2 – Phone conversations. These conversations were the researcher's first personal contact with the companies and started the process of establishing a rapport with participants at the final case study companies. Questions included asking for more detail about software systems installed, the processes they covered and reasons for the choice of software. Data analysis comprised a period of reflection on the data provided at both stages 1 and 2. The researcher considered the criteria identified to constitute an appropriate case study company and mixture of companies to allow comparison: full ERP implementation, not just one module (e.g. finance); a willingness to upgrade their systems; manufacturing companies in a similar field (automotive); companies of a similar size and less than 500 employees; located in diverse cities to make generalisation more viable; and using comparable IS systems but preferably not all the same. Reflecting on these criteria the three case study companies emerged as the participants most likely to be able to answer the research questions.

Stage 3 – Detailed questionnaire. With the three case study companies identified, they were sent a detailed questionnaire designed to collect data on each phase of ERP implementation covering all three change dimensions (people, process and technology). Once the questionnaires were returned, at first the researcher read them to identify areas that did not provide sufficient information in order to inform the interview stage of data collection. Full data analysis was delayed until after the interviews had been conducted. In terms of detailed questionnaire data analysis, each company was initially analysed separately to identify their plans, actions and outcomes for each phase of implementation covering each of the dimensions. As mentioned in chapter three, many models of IS implementation exist in the literature, such as Zuboff's Automate, Informate, Transformate Model, the People Capability Maturity Model, the Stages Growth Model, the Process Maturity Model and many others that have been designed to evaluate information system adoption in developed countries. For the purpose of this research, the researcher builds upon the Stages of Growth Model to assess technology change, the People Capability Maturity Model to assess people change, and the Automate, Informate, Transformate Model and Process Maturity Model to assess process change in three case studies to support the analysis arguments. By delaying data analysis until after the interviews had been conducted, the researcher was able to combine the data analysis of the questionnaire data with the interview data (complementary to the questionnaire questions) together with the documentary evidence provided in conjunction with of the interviews.

Stage 4 – Semi-structured interviews and documentary data.

As mentioned above, the interviews were designed to collect additional, in-depth data on areas of interest from the questionnaire findings; as such, the interview questions were adapted slightly to each case study company (see appendix 1). However, whereas several respondents were interviewed in each case, they all received the same questions. Data analysis was conducted in conjunction with the questionnaire findings in light of documentary evidence provided during or just after the interview, such as company process maps. One case study company (IBC) allowed the researcher to remotely access their IS systems to see the functionalities of their modules, the other two provided screen-shots. Data analysis therefore consisted of the application of the conceptual model (see figure) to the totality of the questionnaire data, interview data and documentary evidence to identify factors that affected the success of the implementation of ERP in each case study, in order to assign these factors to a change dimension (people, process, technology), and consider their relative importance to the three phases of implementation. This process enabled the researcher to develop a new framework for ERP system adoption and implementation for SMEs in Iran, which can be seen in figure 46 (IS Implementation Model in Manufacturing SMEs in Iran). This model shows the factors identified by the data analysis as most influential to successful IS implementation in Iranian SMEs and assigns them to the appropriate dimensions and phases of implementation, with the relationship between the factors indicated by arrows.

4.5.3.2 Triangulation

Triangulation refers to using different methods of data collection about the same phenomenon (Polit & Beck, 2012) in order to ensure the accuracy of collected data. Triangulation is most suitable for qualitative studies, which may include interviews, observation, qualitative questionnaire, and field notes (Polit & Beck, 2008). This study, in order to ensure the accuracy of collected data, employed different data collection approach including questionnaire, interview and observation.

4.6 Ethical Issues

Considering the ethical issues is one of the most important parts in the research project.
Saunders *et al.* (2007) defined research ethics as researcher relevant behaviour with regard to the rights of those people or organisation who participate in our research project.

Confidentiality and the right to withdraw from partaking were two issues considered in this research in order to curtail any of the recognised risks of participants being unwilling to cooperate in research. The researcher followed the guidelines set out in *Research Ethics: A Handbook of Principles and Procedures* (2008) and ensured the confidentiality of the research participants and their companies.

4.6.1 Confidentiality

In this study, all the data from case studies that gathered through questionnaire, in-depth interviews, and company documents is anonymous. No individual identified at any point this study. Also in the questionnaire there was no requirement to state their name, company name or address. It was made clear with companies that all data collected was used only for completing this research project.

4.6.2 Withdrawal from Participation

Participant were informed from the start of the project that they could withdraw at any point in this research. They were advised that they did not have to fill in the questionnaire or they could end the interviews at any stage.

4.7 Summary

This chapter started by introducing research philosophy, purpose, approach, and research strategy in order to examine the theoretical foundations of this study. Research methods, survey, and case study were also reviewed. The study comprised three exploratory case studies and adopted an interpretivist approach to the qualitative data collected. The chapter provides detailed models of the four stages of data collection and data analysis processes (figures 13 and 14) and explains the concurrent approach to the case studies through four stages of data collection, culminating in a cross case analysis once all the data for each case study, (including the integration of documentary evidence provided by the case study companies), had been analysed. Furthermore, it explains the application of the conceptual framework to the data collection and analysis based on the three dimensions of change and three phases of implementation, which allow a chorological approach to the data analysis. In summary, to achieve the aim of the research, the methodology consisted of multiple case studies, allowing generalisations to be made that are grounded in the findings from the cases. Questionnaires, interviews, and documentation were used over a six-month period of data collection. The next chapter provides a detailed discussion of data collected from the survey and the case studies.

Chapter 5: Case Study Findings

5.1 Introduction

This chapter draws together the findings from the survey questionnaire (Appendix 1), the detailed questionnaire (Appendix 1) and the follow up interviews (Appendix 1) undertaken with manufacturing SMEs in Iran. The case study method is as described in Chapter 4. Aliases are used to maintain confidentiality. Process mapping and systems profiling were performed to establish the current status of software implementation in these manufacturing companies. The survey questionnaire investigated the extent of ERP systems implementation in Iranian manufacturing SMEs. Each case in this chapter investigates the underlying information systems strategy and examines how this has been implemented in the core process areas of these companies. This chapter has six sections, comprising this Introduction to the chapter, Survey findings, the IBC case study, the ETS case study, the PSC case study, and a Conclusion.

5.2 ERP Implementation in Iranian SMEs: Survey Findings

In order to answer the first research question, the researcher developed a survey to investigate the extent of ERP systems implementation in Iranian SMEs. The survey aimed to determine the extent of these SMEs' uptake of information systems or ERP systems.

To ensure that the research findings reflected the existing situation as precisely as possible, the survey was sent to 75 SMEs located in the Isfahan and Tehran provinces as two of Iran's main industrial areas. A total of fifty companies completed the survey. Respondent organizations represented a diverse sample of industries, sizes, revenues, and goals. However, all respondent organizations reported not having experience of western developed ERP solutions such as SAP. Table 11, below indicates that there are some distributors of western ERP packages such as SAP or Oracle in Iran.

Samehara	http://www.samehara.com/en/	SAP provider
RaySAP	http://www.raysap.com/en	SAP provider
IRISA	http://www.irisaco.com/	Oracle provider
Caspian services provider	N/A	Oracle provider
IranOracle	http://www.iranoracle.ir/	Oracle provider

Table 11: Distributors of Western ERP Packages in Iran

Seventeen companies reported that they are using domestic TOTAL or integrated systems. Twenty-one organizations are using standalone packages such as CRM, finance, MRP and product design packages (see Table 12, below).

TOTAL/ Integrated packages (home developed ERP packages)	17
Standalone packages	21
Microsoft Office applications	12

Table 12: Information System Usage

Of the remaining respondents, twelve companies have no specific information systems packages, but mostly used the Microsoft Office package. However, several companies claimed they were keen to implement an integrated solution or implement other information systems such as CRM and financial packages. A few mentioned they were already in the process of selecting software. Organisations with integrated software claimed that they would like to upgrade or add a functional area to their existing systems. Organizations that implemented TOTAL or integrated software – basically home developed ERP packages - did so in order to replace out-of-date, old legacy or in-house developed systems, or because their operations were largely manual.

A note on Iranian ERP implementation contracts

The study findings, particularly from the three case studies, indicate that the typical contract between ERP software vendors and their customers in Iran was somewhat different from what is usual in developed countries. Generally, the contract was for a term of 2-3 years and covered implementation and training, but not upgrades. Moreover, vendors were able to tailor their offering to the budget available, offering a fixed term of support for whatever funds were available. In one of the case study companies (IBC) the company took a hiatus in its vendor contract while waiting for payment for a large manufacturing contract to become available, and then resumed support from the vendor approximately a year later. However, the key difference in Iranian vendors' ERP contracts was found to be that upgrades to the software were not included and there was no expectation of an ongoing payment from the customer in return for permanent support from the vendor.

5.3 Isfahan Bus Company (IBC)

5.3.1 IBC Background

The Isfahan Bus Company is located on the main north–south and east–west routes crossing Iran and occupies a site of 50,000 m2, including and 24,000 m2 of the production building space in the industrial city of Najafabad in Isfahan province. The company was founded in 1985 as a family business based on auto body parts manufacturing, moulding, and structure designing and production. The company was registered in 1984, currently employs 350 staff and designs, manufactures and sells a range of buses, vans and spare parts. In addition to the one main site noted above, the company has ten third party distribution and after sales agencies for promoting sales and marketing across Iran (Isfahan, Tehran, Shiraz, Mashhad, Hamedan, Yazd, Kerman, Kermanshah, Tabriz, and Semnan). The company's major customers are listed in table 13). All company employees work on the company's main site in Najafabad.

Major Customer
Municipalities and rural management organisation
Public Transport and Urban Traffic of the Country's Municipalities and Village Administrators
Transportation and Terminals Organization
The Public Relations Association of Urban Buses Suburban bus system

Table 13: IBC's Major Customers

5.3.2 IBC Questionnaire Respondents and Interviewees

As noted in Chapter 4, data collection was achieved through questionnaires, interviews, and documentary evidence. A detailed, structured questionnaire was filled in by three respondents in IBC, and follow-up interviews have been conducted with the questionnaire respondents. Table 14 provides an overview of the respondents' job roles and their involvement in the recent IS implementation project.

Respondent position	BEHKO project involvement
Head of IT (R1)	He was heavily involved in supporting main departments in specifying their requirements and in package selection. In the implementation phase, he had regular meetings with department heads to progress check and make sure they understood the implementation process.
Head of quality control and engineering (R2)	He was on the Project board that was responsible for selecting and implementing the Total Systems solution. As a main user and responsible for overall project quality, he represented individual departmental needs, and met with the Head of IT regularly.
Head of commercial department (R3)	He worked closely with the Head of IT in the selection and implementation processes, identifying and planning training for most of the staff.

Table 14: IBC Respondents

5.3.3. IBC Organisation Structure, Processes and Current Systems Deployment

IBC has the following departments: Finance, Commercial (Sales and Marketing/Purchase and Procurement), Human Resources, Engineering, Logistics and Distribution, and Shop Floor and Production (Figure 15, below: documentary evidence). According to the respondents' answers, the company's overall business strategy is to increase production and pass the quality control criteria needed to win government bids.

The Head of Commercial explained that they aimed to invest in the manufacturing of new buses and minibuses, and also to modify their buses' and minibuses' functionality based on government requirements. He also stated that, in the competitive market in Iran, this would require IBC to reduce costs, improve quality, innovate new designs for buses, and increase production volume. The head of Quality Control stated that the company's objectives for the next five years were to increase sales to government and other sectors, to expand the business globally, and to become a leading manufacturer in the Middle East. Alongside company business objectives, the objectives and plan for IT for the next five years had been set as replacing the remaining manual systems, to make company processes as efficient as possible, and reduce employee numbers.

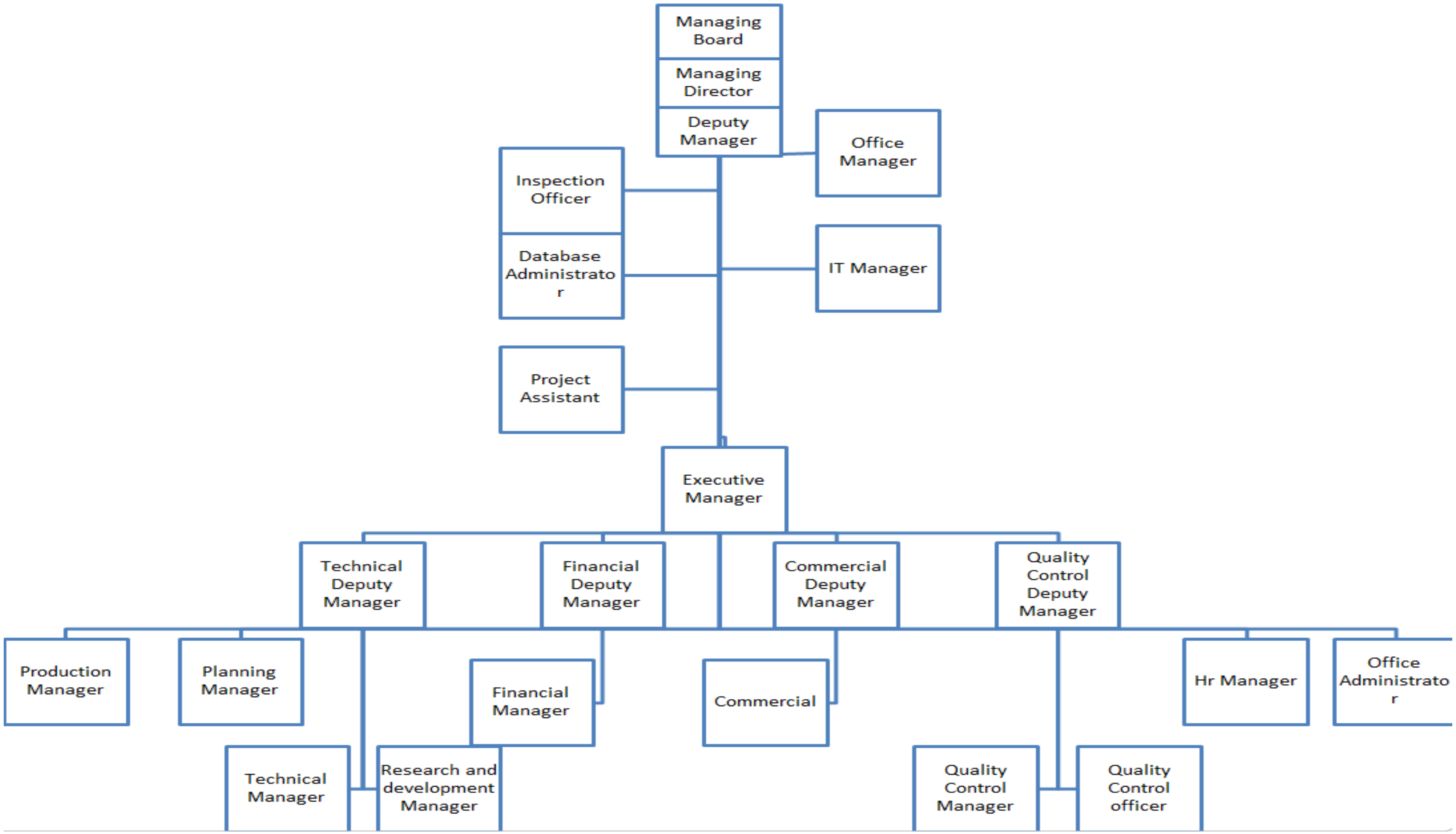


Figure 15: IBC Organisation Chart

5.3.3.1 Processes and Sub-Processes in IBC

Business processes in IBC can be grouped into six major processes and a number of sub-processes. These activities are briefly outlined below, alongside the information systems that currently support these business processes. These are summarised in Figure 19, below.

Manufacturing

The manufacturing process comprises three sub-processes: production planning and production, quality control, and engineering. Production planning was automated via the materials requirements planning (MRP) module of the BEHKO system. This systems module assesses the requirements for production against current company stock and suggests replenishment works orders for the appropriate dates and quantities to meet production requirements. The system takes account of current stock levels, outstanding orders, and minimum purchase order quantities. It will suggest a schedule of what should be made and when, what should be purchased and when, and current and future loading of production lines, by resource by week. This sub-process includes the bill of materials (BOM) function. When the MRP module receives an order, it will also create a list of required components to make that order. The MRP module also has additional forward planning functionality. It has the capability to plan requirements for meeting new orders and rescheduling existing orders.

In contrast, the quality control and engineering sub-processes are only partly automated. These sub-processes are supported by Microsoft Excel and Access to monitor, store and report upon key events and stock transactions. These include inspection and testing records, and inventory transactions for engineering parts.

Sales and Marketing Management

The sales and marketing process is automated and supported by the BEHKO system. There are two sub-processes – sales management and marketing management. The sales management sub-process is supported by BEHKO sales management module (see Figure 16, below) that encompasses customer records, sales orders, price lists and quotation functions. The marketing management sub-processes is supported by a BEHKO CRM module.

A customer record includes customer details, customer status, and customer discount, and access the sales ledger, which shows outstanding invoices directly and displays these along with live data from BEHKO so that sales and purchasing staff have real-time financial data. Sales order function enables users to add/ edit the sales order and sales report. The Price list shows product specific prices and the quotation function processes requested quotes and generates quotation reports to send to customers. Marketing management is automated with the BEHKO CRM Module, which enables users to manage day-to-day routine along with handling contact, prospects, customers, and suppliers. For example, in the Note tab (Figure 16, below: documentary evidence) users can leave a note to record a conversation etc., notes can be categorised to require follow up action or just a normal note, e.g. a thank you note from a customer. The Activity tab has a similar structure to Notes except that users in this tab can follow up date and time. The checklist advantage lets users go back to the history and check daily tasks or search for previous information.

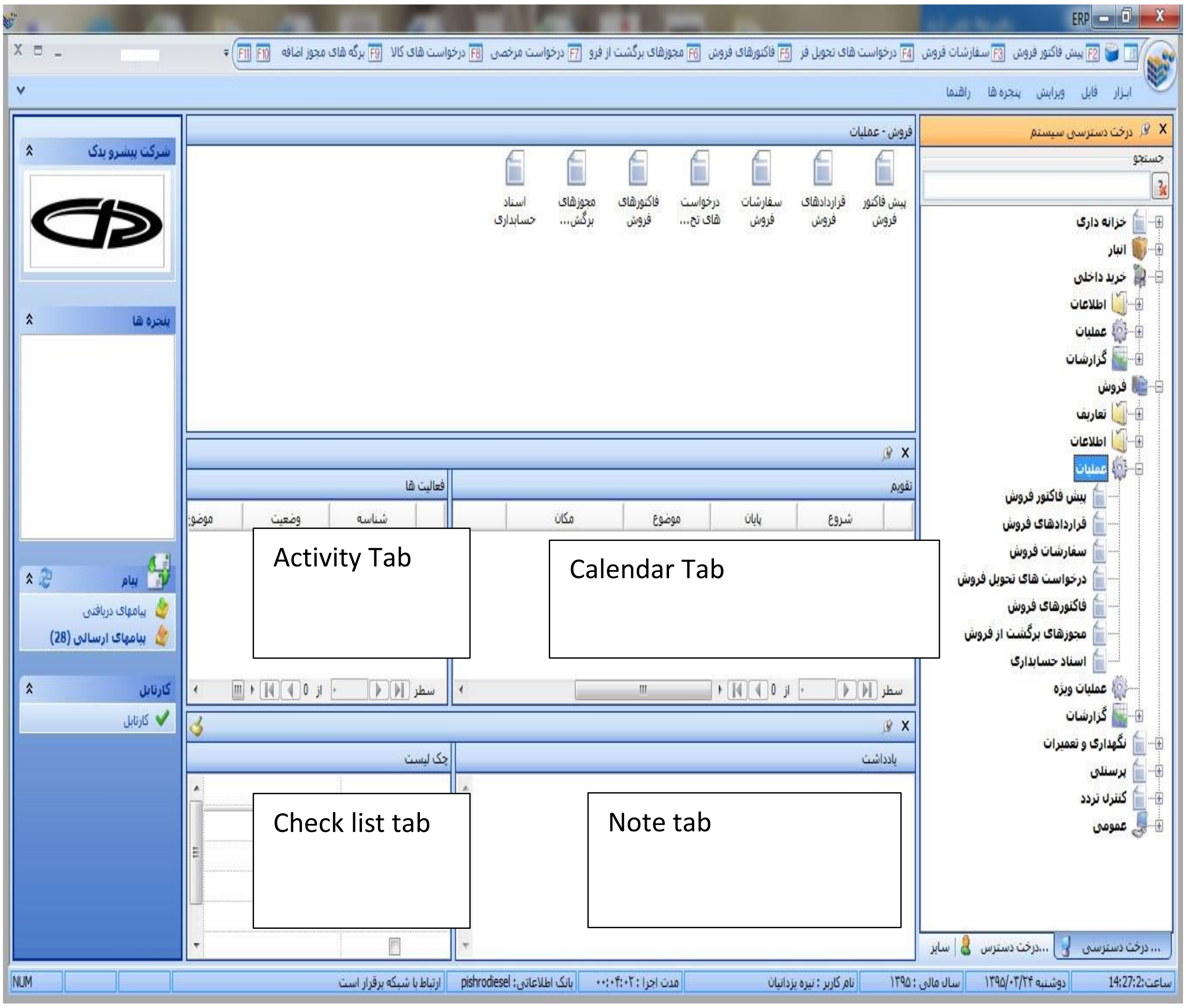


Figure 16: BEHKO Sales Management Sub- Process Interface

Purchasing and Procurement

The purchasing and procurement process centres on purchasing management and related operations. Purchasing management is supported by the BEHKO purchasing module, which provides a full range of purchasing functions. Figure 17 (documentary evidence), illustrates how Purchasing and procurement works: for example, how MRP is integrated to purchasing modules. The Figure shows when MRP module calculates requirements to fulfil a works order, a purchase requisition is generated electronically to be accessed by the purchasing department, and processed as a purchase order on the system; copies are also made available electronically to the finance department. The BEHKO purchasing module generates unique supplier reference codes and provides purchase reports for each supplier. It also has the capability to assess suppliers' credit worthiness and overall supply performance, and also attach picture, voice or any other document to supplier files.

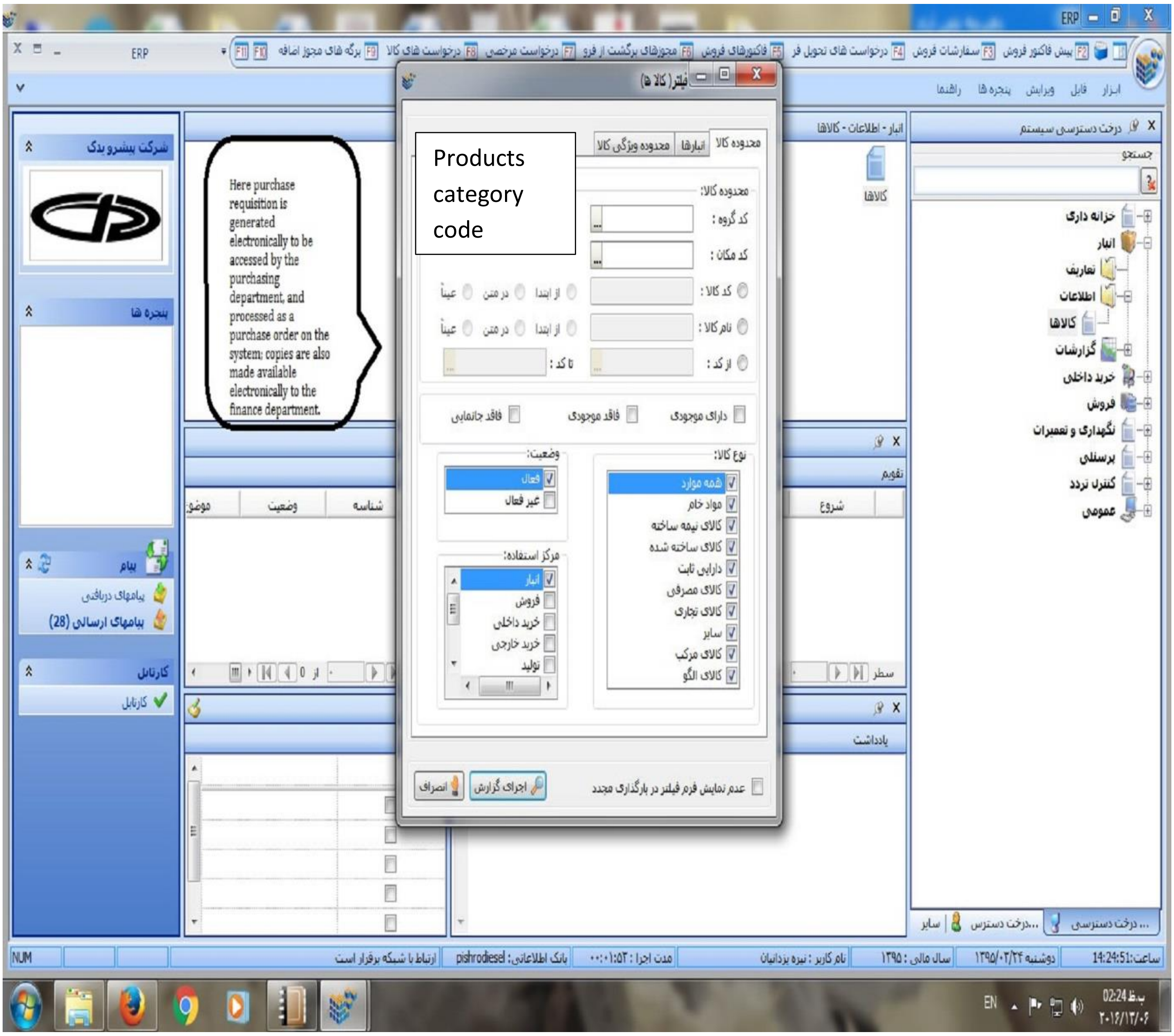


Figure 17: BEHKO Purchase and Procurement Module Interface

Financial Management

The financial process is automated by the BEHKO finance and accounting module. This process shows financial figures, which show sales order book (accounts receivable), purchase order book (accounts payable), outstanding invoices and staff payments, alongside company general ledger and cash management process (see Figure 18, below documentary evidence). This process takes current outstanding sales orders to raise sales invoice to customers. Finance also matches the purchase invoices. The process will look at purchase reports if in case if there is any item to return to suppliers. This module is able to define the financial period with the start date and the end of the desired and register operations in each course, and also defining a variety of foreign currencies and exchange rates into domestic currency. For example, in the accounting option users can select the currencies or exchange rates function; when users set a currency code for a supplier or customer, all reports, invoices, purchase order, order sales order for that supplier or customer will be in their currency.

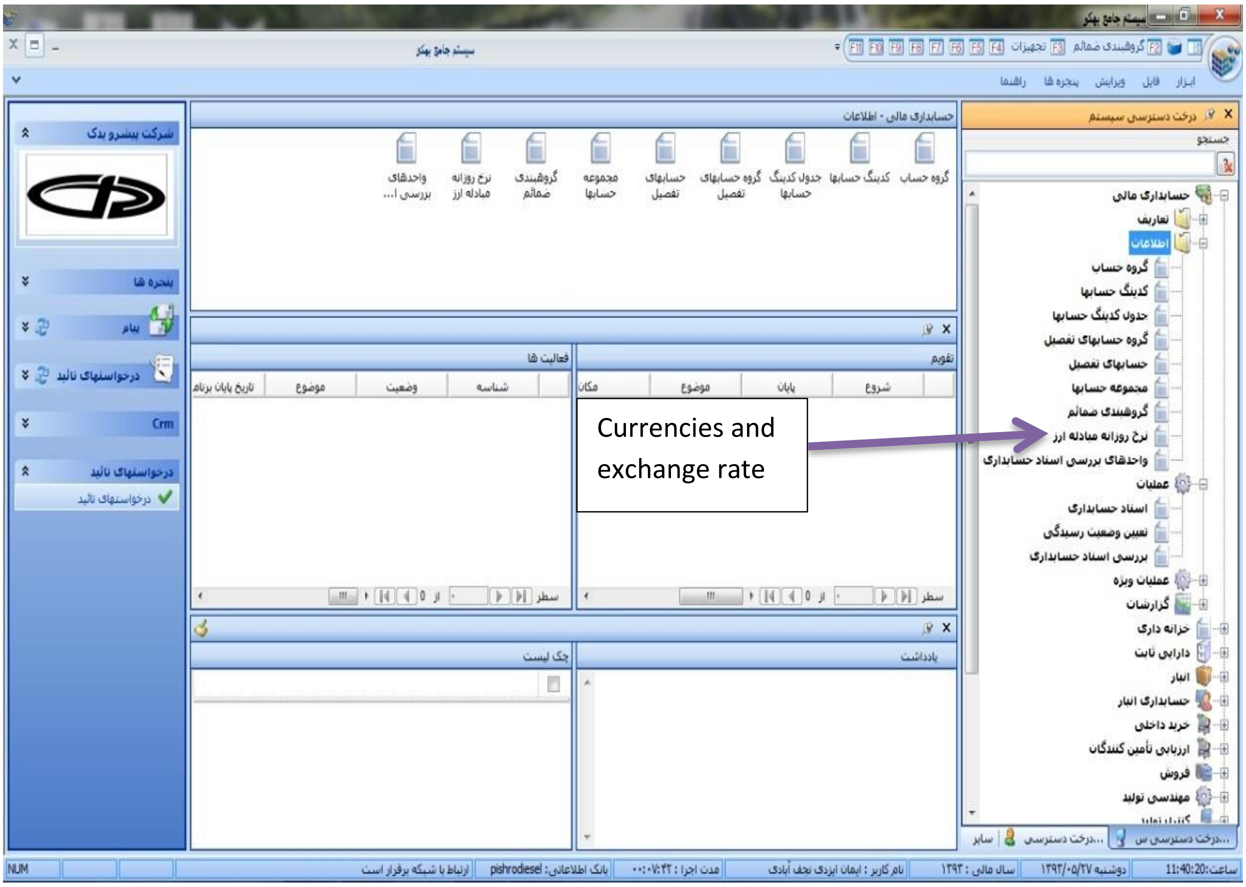


Figure 18: BEHKO Finance Module Interface

Logistics and Distribution

The logistics and distribution process has three sub-processes - inventory management, primary distribution and aftersales services, and agency distribution. Inventory management is automated via the BEHKO stock control system. Primary distribution and aftersales services manage customers' orders to ensure customer delivery and post sales service. This sub-process is supported by an off-the-shelf after sales information systems package called SEVEN. The agency distribution sub-process involves the sale of spare parts for buses and other vehicles via company agencies located in different cities in Iran. This process is partly manual and partly automated by the use of spreadsheets.

Human Resource Management

The human resource (HR) management process can be subdivided into three main sub-processes: personnel management handles employee records (including payment, staff absence and leave, and timesheet recording) and this is centrally managed and automated using the BEHKO HR systems module. There are also the staff training and health and safety sub-processes, which are mainly manual.

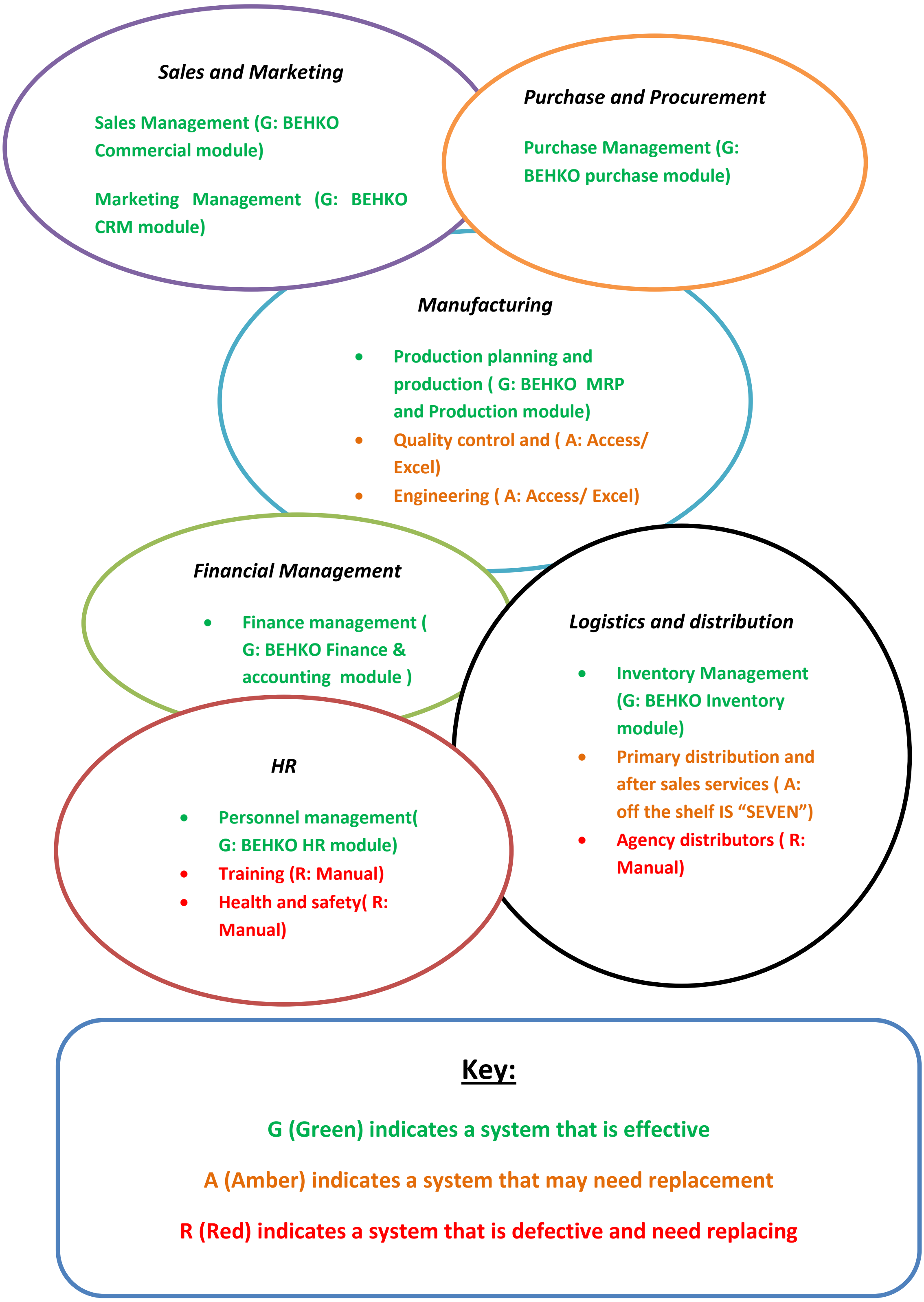


Figure 19 Main Business Process and IS Profiling in IBC

The information system strategy adopted at IBC centred on the phased introduction of BEHKO total system. BEHKO is an Iranian Brand; the preference was based on the language used to display the software (Parsi), and easy access to the software company for maintenance or upgrade. IBC elected to pursue a phased implementation to let employees adapt to the changes. It took three years to implement the system. The logistics and distribution module was customised based on requested requirements by the head of department. Several sub-processes were still manual and required the use of spreadsheets and exchanging files within the departments (see, Figure 20, below).

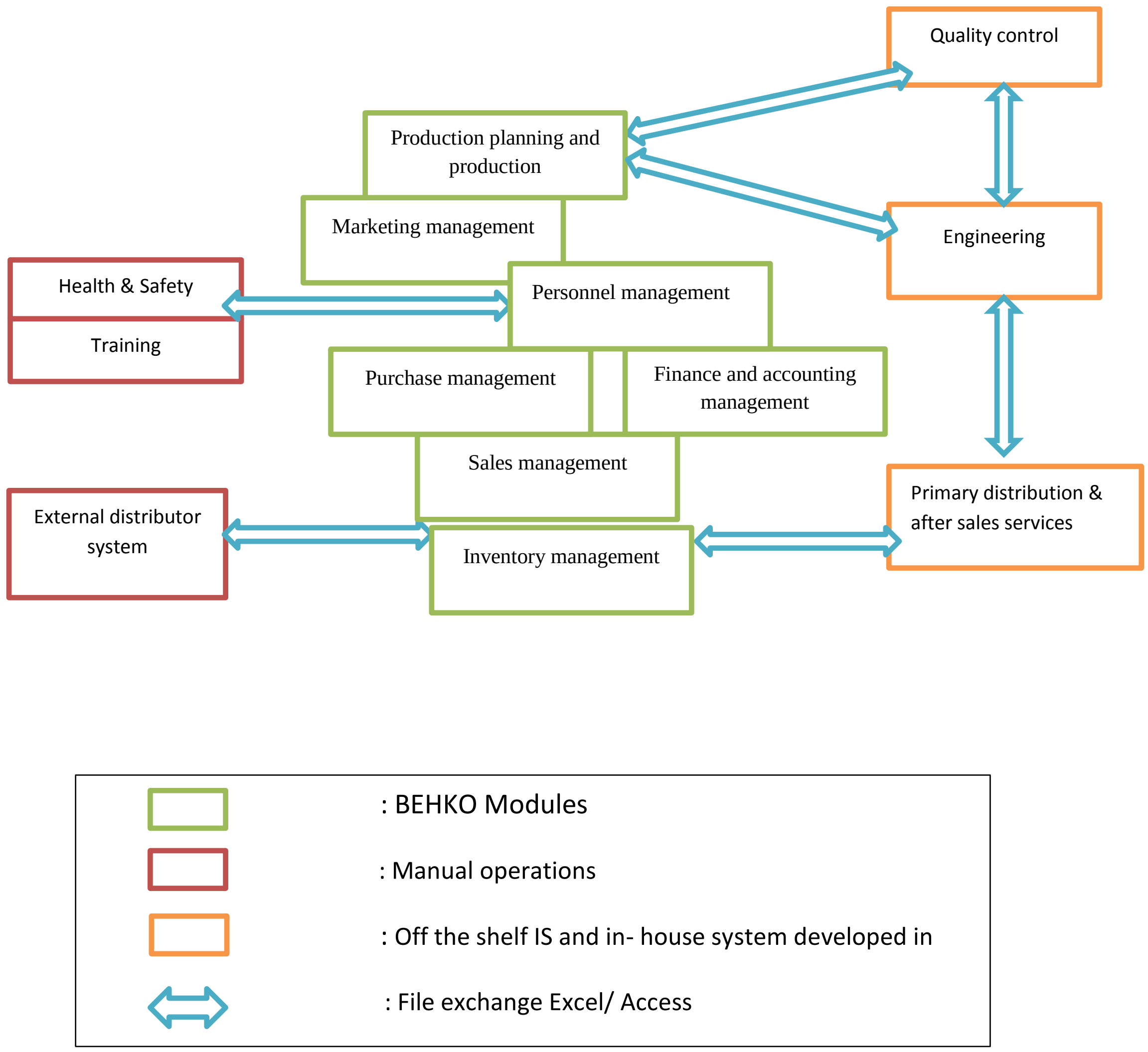


Figure 20: System Interface in IBC

All the BEHKO system modules are integrated; however, they are not integrated with other processes using Excel/Access or SEVEN in information system. The BEHKO system was developed in C++ and uses the SQL database. Top-level managers are the only ones who can administrate the system in case of mistakes made entering the data derived from manual processes. They also have access to all reports and invoices generated by system. The financial module can provide them an overview of all sales, purchases, stock, and employees reports.

5.3.4 Pre-Implementation Phase

5.3.4.1 Rational for ERP/ Pre-Existing Systems and Technology

The previous information system (the SHOMARAN package) at IBC, which adopted in 2003, was an Iranian product but had limited capability and only automated the financial and sales processes, which were not well integrated (see Table 16, below). The system also had not been developed well based on departmental needs. Besides lack of integration, the data accuracy and duplication was another problem, which had negative impacts on production line efficiencies, decision making and customer service. According to the Head of IT, there was also a lack of security and privacy, as IBC had only one server to manage both software and database which was not secure. The database backup was scheduled weekly on the same server. User access and privileges for all users including heads of departments was the same, and all users had the same username and password. System admin was undertaken by a third party from the vendor company. The Head of IT stated that having third party was not ideal as he was not available all the time. The Head of IT was too busy to monitor and audit database regularly. Operating system and antivirus software had not been updated. There was no electronic central system that connected to the various sub- systems. IBC had not provided email service for users to communicate, and users used to use their personal email. All available PCs ran with the Windows 7 operating system and MS office.

There were some internal and external issues which impacted upon the company's ability to continue with the previous system within their environment. For example, poor internet connection affected communication within departments; for example, employees were sometimes unable to contact each other by email. Another issue was the frequent power cuts caused by external suppliers. In addition, the old system was not compatible with new back up tools that work in a power cut situation. The Head of IT stated that there was a need to provide hardware that was compatible with a standard industrial environment, because the operation of heavy machines on the shop floor affected the stability of nearby buildings.

The key issue that needed addressing in IBC was inconsistent product information (for example there was not any specific product name or part number for each product), with the resultant "incorrect production" and "incorrect order" errors. IBC also was keen to improve their production planning and production process, as the company developed their production line, this system was not aligned with company strategies and could not support business improvement. In order to achieve this objective, IBC decided to acquire one integrated package - an ERP or TOTAL system - to replace their legacy systems.

Processes	Modules	Users	Pcs	Server
Finance	SHOMARAN Finance module	5	3	
Sales	SHOMARAN Sales module	6	4	
Purchase	MS Excel	4	2	
Logistic	MS Excel	2	1	
Product design	CAD	3	2	

Table 15: Previous Systems Users n IBC (Pre-ERP project)

5.3.4.2. Package Selection Process

Package selection was a formal decision made by the project board and project team. The project team included selected managers from across all departments - commercial, finance, production, engineering, quality control, and the Head of IT. According to respondents, the project team set up a committee from across all departments. The committee was responsible to provide a shortlist of product from several vendors for a system demonstration. The committee and project team focused on functionality of different software introduced by different vendors and tried to find out which product was best aligned with company business process, alongside presenting and introducing each module to its main users in a planned sequence. IBC selected BEHKO TOTAL system for further investigation, including a workshop for each module and detailed discussion on functionality, user requirements and price negotiation. BEHKO is an Iranian software company, and its selection was based on functionality, and language – it uses only Parsi– and easy access for systems support and upgrade.

5.3.5 Implementation Phase

5.3.5.1 Module Implementation History and Process

The strategy was a formal decision made by the project board and project team. The strategy was a stage by stage implementation of the BEHKO total system, and a gradual replacement of previous off-the-shelf systems. In 2008, the BEHKO systems modules were introduced in stages. The software vendor continues to provide support and maintenance; Key users were defined with roles and responsibilities. The initial focus was to be on the logistics and distribution process area, to establish consistent inventory product codes and simplify and standardise product information for both internal processes and also for customer facing sales and marketing departments. Then they implemented rest of the module. The delays were due to unexpected internal and external factors that significantly impacted the company. For example, lack of financial sources or in some cases some main users left and the company needed to replace them. The head of sales and marketing noted that the delays did allow users to familiar themselves with new system and associate procedures. Figure 21, below indicates IBC Gantt Chart (Documentary evidence).

ID	Task Name	Duration	Start
1	Preparation Request for proposal (RFP)	49 days	Sun 01/04/07
2	Search for new system	48 days	Sat 16/06/07
3	Appointmnet of project board and project Team	14 days	Sat 01/09/07
4	Short listing of product	22 days	Sat 22/09/07
5	Package and module selction	6 days	Wed 24/10/07
6	project planing and identifying IT needs	15 days	Sat 10/11/07
7	selecting main users and responsibilties	12 days	Wed 05/12/07
8	data prepartion and data conversion for Inventory	21 days	Tue 01/01/08
9	Installing inventory module on 2 computes	1 day	Sun 10/02/08
10	Data migration on database server	1 day	Tue 12/02/08
11	Intial training for inventory module	18 days	Mon 25/02/08
12	Installing inventory module on rest of computers	5 days	Fri 04/04/08
13	Training	23 days	Tue 15/04/08
14	Go live	22 days	Fri 16/05/08
15	Support and maintenance	119 days	Tue 17/06/08
16	project stop due to the finacial issues	271 days	Mon 22/12/08
17	Preparation for rest of modules	89 days	Sat 02/01/10
18	Data prepartion and data conversion	93 days	Fri 07/05/10
19	Installing finance module on 5 pcs	1 day	Mon 11/10/10
20	Installing manufacturing module on 5 pcs	1 day	Mon 11/10/10
21	Installing sales and marketing module on 5 pcs	1 day	Mon 11/10/10
22	Installing purchase and procurmentmodule on 5 pcs	1 day	Mon 11/10/10
23	Installing HR module on 5 pcs	1 day	Mon 11/10/10
24	data migration on database server	1 day	Mon 11/10/10
25	Training program for finance	6 days	Mon 25/10/10
26	Training program for manufacturing	4 days	Fri 05/11/10
27	Training program for sales and marketing	8 days	Thu 11/11/10
28	Training program for purchase and procurment	28 days	Thu 25/11/10
29	Training program for HR	2 days	Wed 05/01/11
30	Go live in finance	15 days	Sat 08/01/11
31	Go live in manufacturing	21 days	Tue 01/02/11
32	Go live in sales and marketing	14 days	Wed 02/03/11
33	Go live purchase and procurment	18 days	Thu 05/05/11
34	Go live HR	16 days	Mon 06/06/11
35	Support and Minatenace	920 days	Sun 26/06/11
36			

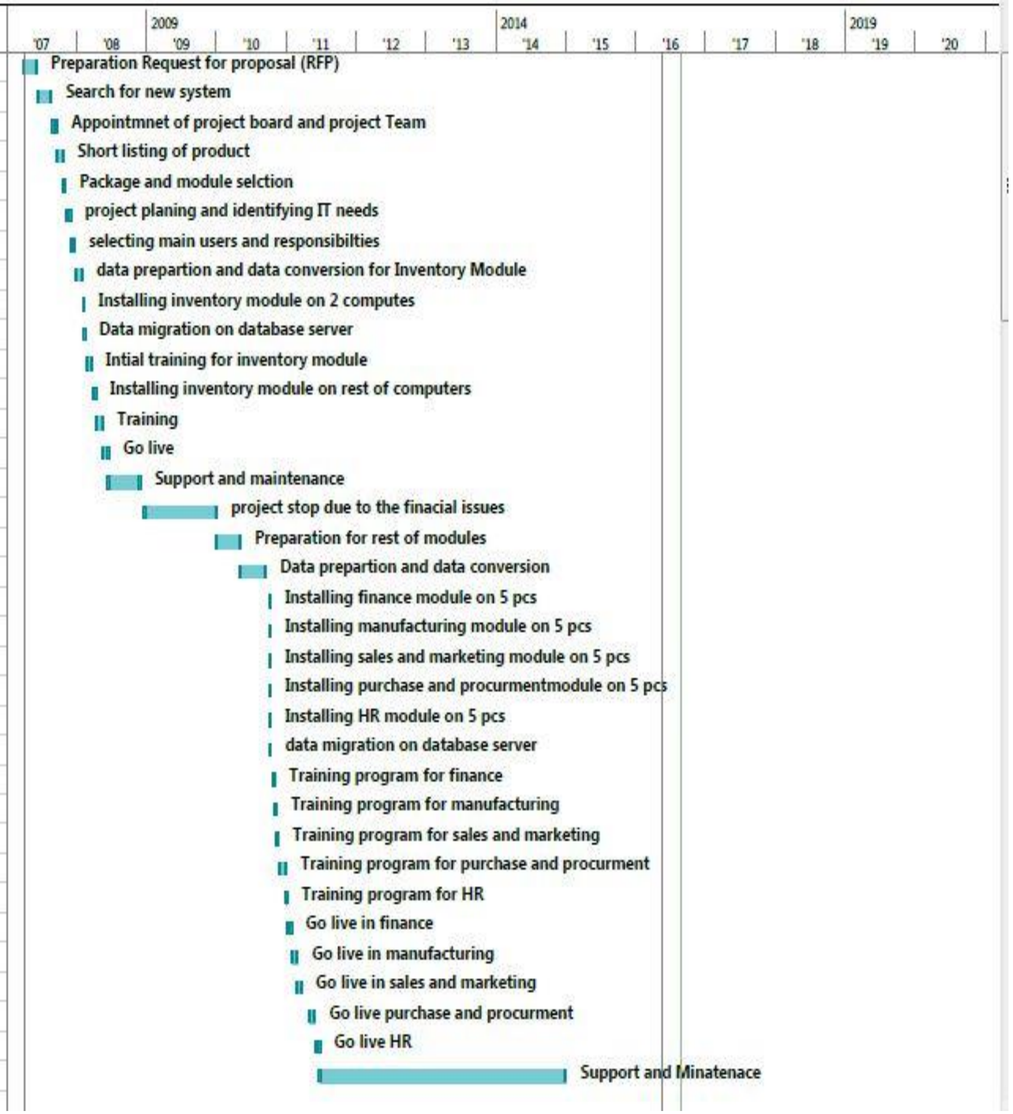


Figure 21: IBC Gantt Chart

5.3.5.2 Technology Infrastructure Development

The IT department consisted of five IT staff including an Head of IT and three IT support staff and one database administrator (DBA), also based in IT. All IT advisors had a BA in computer science and a good knowledge of Oracle and the SQL database as well as C++ and JAVA. The database administrator is also qualified in computer science and experienced in programing languages and analysing systems. IBC has five servers including, database server, software server, backup server, webserver (Email) and antivirus server (see Figure 22, below, documentary evidence). Windows 2012 R2 are installed on all the servers. Microsoft SQL 2008 was installed on the database server, the BEHKO modules run on the software server, email and website run on the webserver, and finally database backup and vital files archive are done on the backup server every day. In addition, IBC installed McAfee antivirus software on all desktop computers and the antivirus server. Also all updates are managed by the antivirus server.

The Internet connection installed in IBC is both wired and wireless. All departments are connected via an intranet that is controlled by privilege policy that manages the workflow.
They follow the single sign-on technique; therefore, they have 100 desktops that are available to 100 and more users. IBC provided twenty portable devices (laptops) if needed for off-site working, or presentations and meetings. All PCs run under the Windows 10 operating system and MS office (see, Table 17, below). The BEHKO system is developed in C++ and uses the SQL database.

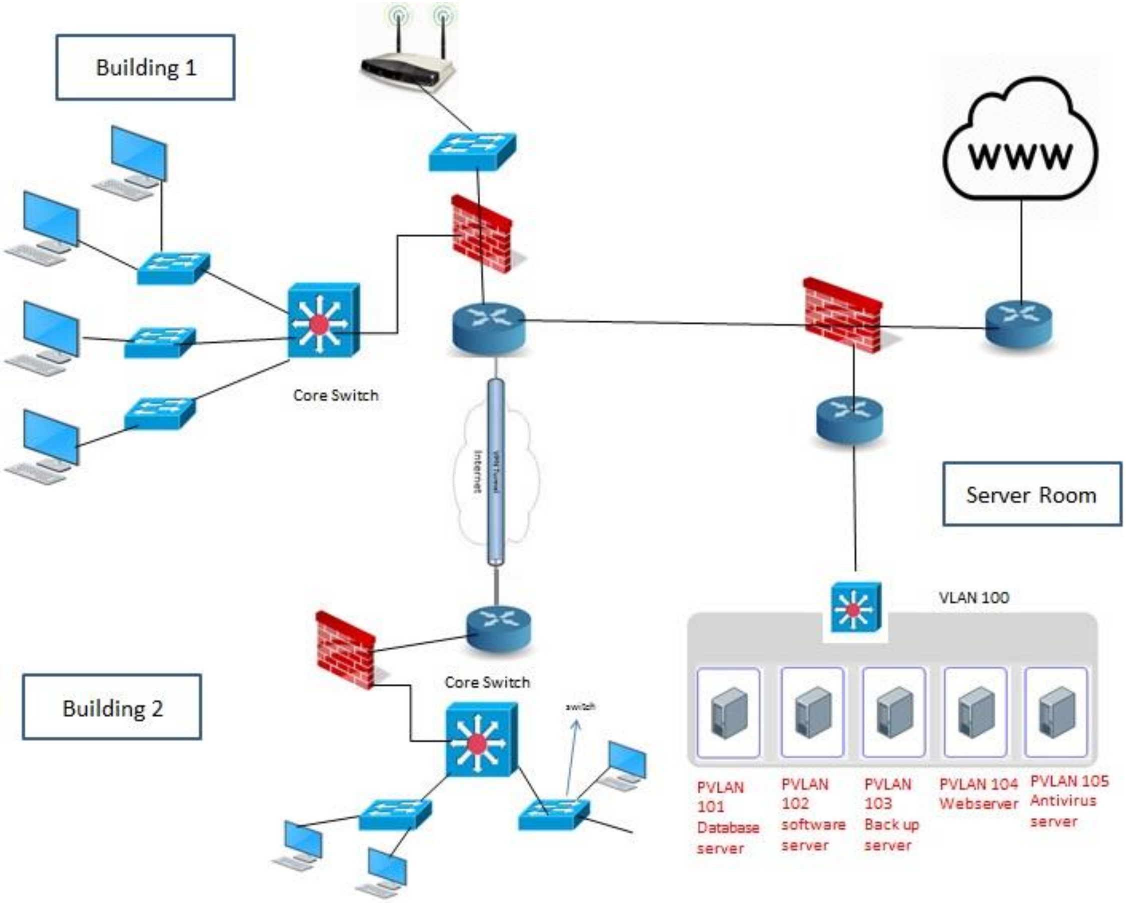


Figure 22: Network Infrastructure in IBC

IBC uses a private VLAN and cisco switch to separate each server for higher security and privacy. Cisco defined VLAN as "a group of end stations in a switched network that is logically segmented by function, project team, or application, without regard to the physical locations of the users. VLANs have the same attributes as physical LANs, but you can group end stations even if they are not physically located on the same LAN segment" (Cisco, 2013). IBC uses firewalls network security to prevent unauthorised access from other networks. The firewalls in IBC are based in three areas.

The head of each department can grant other users with extra or less access to different functional areas of the system. BEHKO is administered by the Head of IT, and senior managers who have access to all the system can generate reports and invoices. The whole system is controlled, maintained, and upgraded by the database administrator (DBA).

Current Process and sub-processes	BEHKO Modules	Main USERS	PCs (desktop)
Sales and marketing	Sales management: BEHKO Commercial module Marketing : BEHKO CRM module	20	20
Purchase and procurement	BEHKO module	15	15
MRP and Production	BEHKO MRP and Production Module	12	12
Financial	BEHKO Financial and accounting module	10	10
Personnel management	BEHKO HR Module	6	6
Inventory Management	BEHKO Inventory module	7	7
Internal distributer and aftersales service	SEVEN	5	5
Quality control	Access/ excel	10	10
Engineering	Access/ excel and CAD / AUTO CAD	15	15

Table 16: BEHKO Modules and Number of Users

5.3.5.3 Process Change and People Aspects

Implementing BEHKO modules involved some changes in company business processes and people aspects, to accommodate the operation of the BEHKO software. These decisions were made by the project team and project board with the consulting vendor. Figure 23, below (documentary evidence), illustrates the BEHKO MRP and production planning process.

In the first step, project organization team and project board was responsible for defining roles and responsibilities. The company had to do a restructure of staff; existing positions were replaced by new jobs and responsibilities, and some positions modified. In order to streamline the processes and sub-processes in the business, a detailed training programme was scheduled by the project board and project team. A new position of IT consultant was added to the organisation, and an IT project manager was selected by BEHKO. The Head of IT was heavily involved in supporting main departments in specifying their requirements and in package selection. In the implementation phase, he had regular meetings with department heads to progress check and make sure they understood the implementation process. He was also formally announced as project coordinator. He was assisting project manager in planning and managing activities as well as participating in managing training and assisting in training workshops. The IT consults had been provided a full workshop of all aspects of BEHKO to assist in implementation process. IT consults also assisting in training. The head of quality control as a member of project team was responsible for selecting and implementing the Total

Systems solution. As main user and responsible for overall project quality, he represented individual departmental needs, and met with the Head of IT regularly. Head of commercial also worked closely with the Head of IT in the selection and implementation processes, identifying and planning training for most of the staff. Main users from each department were selected by head of department for training on key functional aspects of the new system. IT manger stated that identifying project team and main users smooth the projects process. It is notable that this factor been mentioned as a critical success factor in Iran (see chapter 2). Head of each department were monitoring data migration of key business information and supervise the main user. All these activities were overseen by the project board.

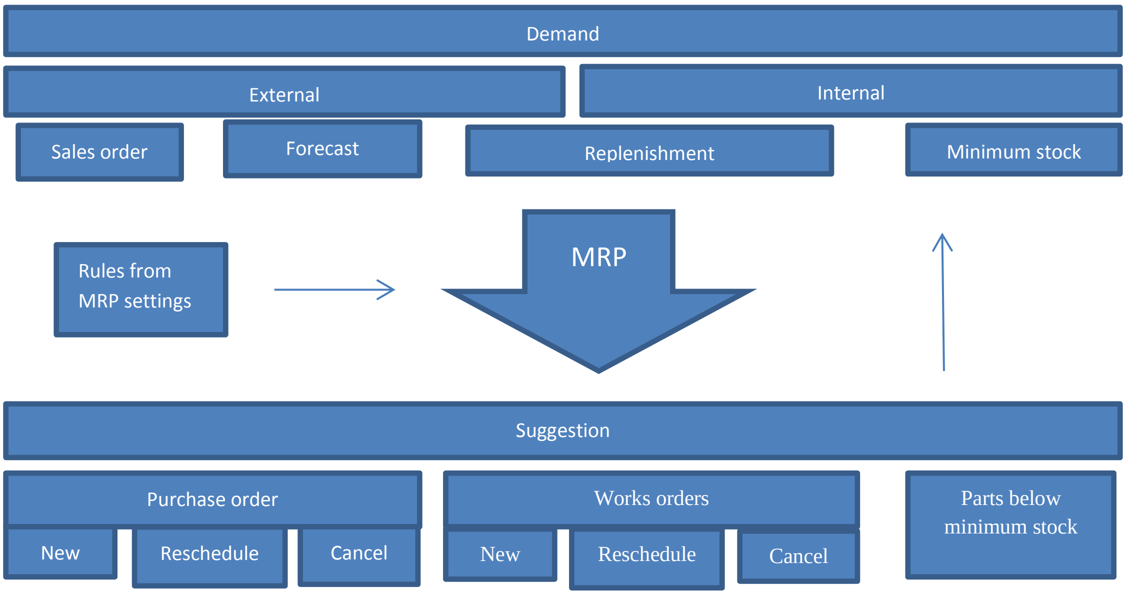


Figure 23: MRP and Production Planning in IBC

5.3.6 Post Implementation Phase

5.3.6.1 On-Going Maintenance and Upgrade

The implementation process took three years, and the system went fully live in July 2011; however, the software vendor supported the company until 2015. Since 2011 they have not upgraded the system; however, they are keen to upgrade it to the new release of the BEHKO ERP system by 2017.

5.3.6.2 Project Costs and Benefits

The BEHKO software had been implemented since 2011 and the business benefits were significant. Now, not only does the company enjoys automated MRP and production, sales and marketing, purchase and procurement, personnel management, inventory management and real time financial data, but they also benefit from improved data quality in many process areas. The project cost 200 million Toman, equal to £50,000. Although the company eventually achieved substantial benefits, the project itself went slightly over time and budget. For example, users now are able to know the inventory level in real time, or managers are able to see finance reports on the system without printing them.

5.3.6.3 Process improvement and people issues

The BEHKO system improved the company processes and sub-processes in line with the project scope and objectives. Some of the main users had some resistance due to the employee's age. The Head of IT asserted that "old employees had the most resistance to accept the changes, as they found it difficult to learn". However, the main elements of the systems project were adequately explained prior to start of implementation. The Head of commercial pointed that the most difficult level of system support was how to satisfy the users and encourage them to learn and share the new knowledge. Table 17 compares the areas that IBC wanted to be supported by the system and what has been achieved.

Process	**BEHKO Modules**	**Scope (planned and achieved)**
Sales and marketing	Sales management: Commercial module Marketing : CRM module	Customer record, sales order, price list and quotation and reporting
Purchase and procurement	Purchase and procurement module	Purchase reports, unique supplier code, assess supplier credit worthiness
MRP and Production:	BEHKO MRP and Production Module	Assesses the requirements for production against current company stock and suggests replenishment works orders, takes account of current stock levels, outstanding orders, and minimum purchase order quantities.
Financial	BEHKO Financial and accounting module	Account receivable, account payable, general ledger and cash management process
Personal management	BEHKO HR Module	Employees record
Inventory Management	BEHKO Inventory module	Stock management

Table 17: Project Scope

5.3.7 Summary

The BEHKO TOTAL system effectively supported the IBC business plan at the time of data collection, the new BEHKO Total system supported most of the business activities; however, IBC was planning a major upgrade to the BEHKO ERP product in 2017 to automate all processes and sub-processes. This package includes improved functionality, which should allow the replacement of the SEVEN package and other standalone applications. The IBC Head of IT stated that BEHKO implementation was successful in this company; he mentioned that having project board and project team at the beginning of the project saved lots of time. Deputy Head of IBC stated that having project manager was very beneficial. He continues his statement by mentioning that this helps to identify project scope, and plan project time and costs before implementing system. All the project activities had been tracked through the project (IBC commercial manager). Head of IT mentioned that all users feel comfortable to use system and are satisfied. They were well trained and know how to work with system. Most company objectives were being achieved.

BEHKO implementation at IBC was more inclined to optimising and supporting key processes such as inventory, production and sales. The BEHKO systems support most of the processes including sales and marketing, purchase and procurement, manufacturing, financial management, logistics and distribution, HR. IBC uses most of the functionality of the system. New system at IBC supported them to gain larger portion of the market share over the last four years in comparison with other automotive manufacturers in Iran. For example, IBC signed a huge contract with Government in order to provide city buses for various cities in Iran.

5.4 Case Study 2: Electronic Transmission Systems (ETS)

5.4.1 ETS Background

The Electronic Transmission Systems (ETS) is located on the main north-south and east- west routes crossing Iran and occupies a site of 6,500 m2 including 2,180 m2 of production building space in the industrial city of Najafabad in Isfahan province (see Table 18, below, company profile). The company was founded in 1978 as a family business based on auto parts manufacturing and structure design and production. The company was registered in 1999, currently employs 160 staff and design, manufacture and distribute electronic vehicles, E-bikes, differential transmission systems (for Pride, Nissan Jounior and Tiba engines), and pinion and gear differential systems and parts. The company annual income is approximately £60,000. ETS has one main site and all company employees work on the company’s main site in Najafabad. Table 19, below illustrates ETS basic components for production.

Current ETS Plant Specification	
Total Area	6500 m^2
Covered Area	3400 m^2
Production Area	2180 m^2
Office Area	520 m^2
Warehouse Area	350 m^2
Energy Resources	Natural Gas, Electricity (3*110 124KW), Generator (300 KVA)

Table 18: Current ETS Plant Specification

Company Raw Materials
Alloy Steal with 45 cm thickness and 50cm diameter
Alloy Steal with 55 cm thickness and 50cm diameter
Alloy Steal with 27 cm thickness and 27/28cm diameter
Alloy Steel 1/7131 cm thickness and 30/40cm diameter
Annual Consumption :1500 Ton

Table 19: ETS Basic Components for Production

5.4.2 ETS Questionnaire Respondents and Interviews

As noted in chapter 4, data collection was through questionnaires, interviews, and documentary evidence. A detailed structured questionnaire was filled in by two respondents in ETS, and follow-up interviews have been conducted with the questionnaire respondents. Table 21 provides an overview of respondent's job roles and their involvement in the recent IS implementation project. In addition, table 22, provides the level of employees 'education in ETS.

Respondent position	GREEN/ GALAX project involvement
Head of IT (R1)	He was heavily involved in supporting main departments in specifying their requirements and in package selection. In the implementation phase, he had regular meetings with department heads to progress check and make sure they understood the implementation process.
Head of Human Resources (R2)	He worked closely with the IT officer and database administrator in the selection and implementation processes, identifying and planning training for most of the staff.

Table 20: ETS Respondents

ETS Staff Education	
PHD/ MSc	2%
BSc	9%
Diploma	28%
Under Diploma	46%
Others	15%

Table 21: ETS Staff Education

5.4.3 ETS Organisation Structure, Processes and Current Systems Deployment

ETS has following departments: Finance, commercial department (Sales and Marketing/ Purchase), Human Resources, Distribution and stock control (inventory), and production and engineering department. Figure 24 below (documentary evidence) describes the ETS organisation chart. According to the respondents' answer, the company's overall business strategy is to increase production and sales.

Head of IT who was involved in selecting the TOTAL systems package stated that expanding sales to current and new customer to achieve an excellent customer service for current and new customer were the driver for deploying information system. The head of human resources specified that increasing production to a high quality standard not only increased sales, but also satisfied their customers. The company's objectives for the next five years were to increase production, improve products' quality, sales, and customer service.

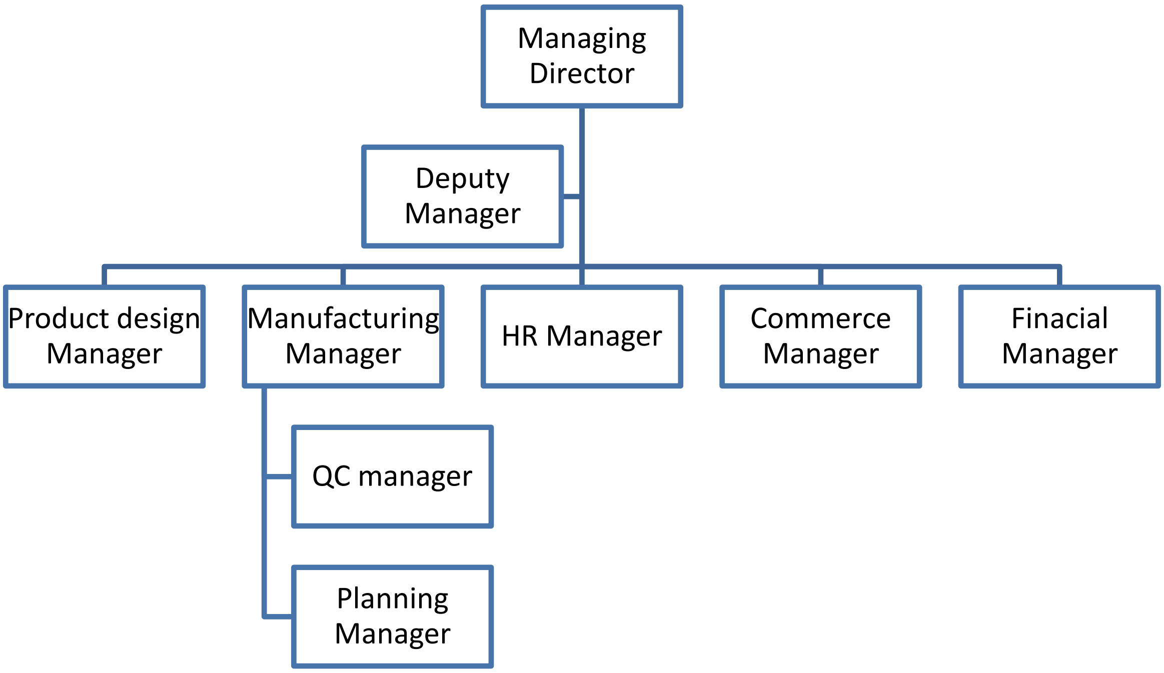


Figure 24: Organisation Chart

5.4.3.1 Processes and Sub-Process in ETS

Initial process mapping in ETS suggests there are six top level business processes, and a number of sub-processes. The processes are briefly outlined below, alongside the information systems which currently support these business processes. These are depicted in Figure 27, below.

Manufacturing

The manufacturing process comprises two sub-processes: quality control, production planning and production. The quality control sub-process encompasses the inspection of both purchased and manufactured parts and products, and the recording and monitoring of test results. The GREEN/GALAX quality control module records and manages all data associated with product sampling, testing and results recording and reporting. Security aspects are supported by systems controls on access, allowing only staff with the required skills and competence levels to undertake inspection testing.

The production planning and production sub-process is automated with the GREEN/GALAX materials requirements planning (MRP) and production module, which determines the quantity and timing of component purchases. The system stores the bills of materials and explodes these into requirements, based on received orders. The production team can attach drawings of product designs and technical specifications to job sheet records. The GREEN/GALAX production module also provides time estimates for parts delivery at production line and for final inspection of finished products. This suggests production team a schedule of what should be made and when the final inspection should be made.

Inventory

The inventory management process covers stock control and is partly automated with MS Excel spreadsheets monitoring manufactured and component products in and out of the stockrooms.

Product Design

The product design process is automated with a range of off the shelf design and planning software packages, including Catia V5R18, MSC Super Forge, Master CAM 9.0, Autodesk Mechanical desktop 2007, Power Mill 6.0, Primavera Project planner, MS project 2007, and Minitab 13.0. This process encompasses the design and drawing of company products based on received orders and customer specifications.

Financial

The financial management process is similarly supported by a GREEN/ GALAX module. There are two sub-processes: accounts management, and general ledger and asset management. The system manages financial activities, financial figures and reports and invoices; it contains the ledgers for sales and purchase transactions, and records company assets, liabilities, owners' equity, revenue, and expenses.

For example, Figure 25, below, (documentary evidence) shows the purchase invoices in a particular period in the system. The Figure shows that before users run the report, they need to define their financial years and set the dates. For instance, here the year 2016 has already been created with 12 periods and marked as an active year. Once they set the dates, they can run their require report such as invoicing report (purchase invoice, sales invoice).

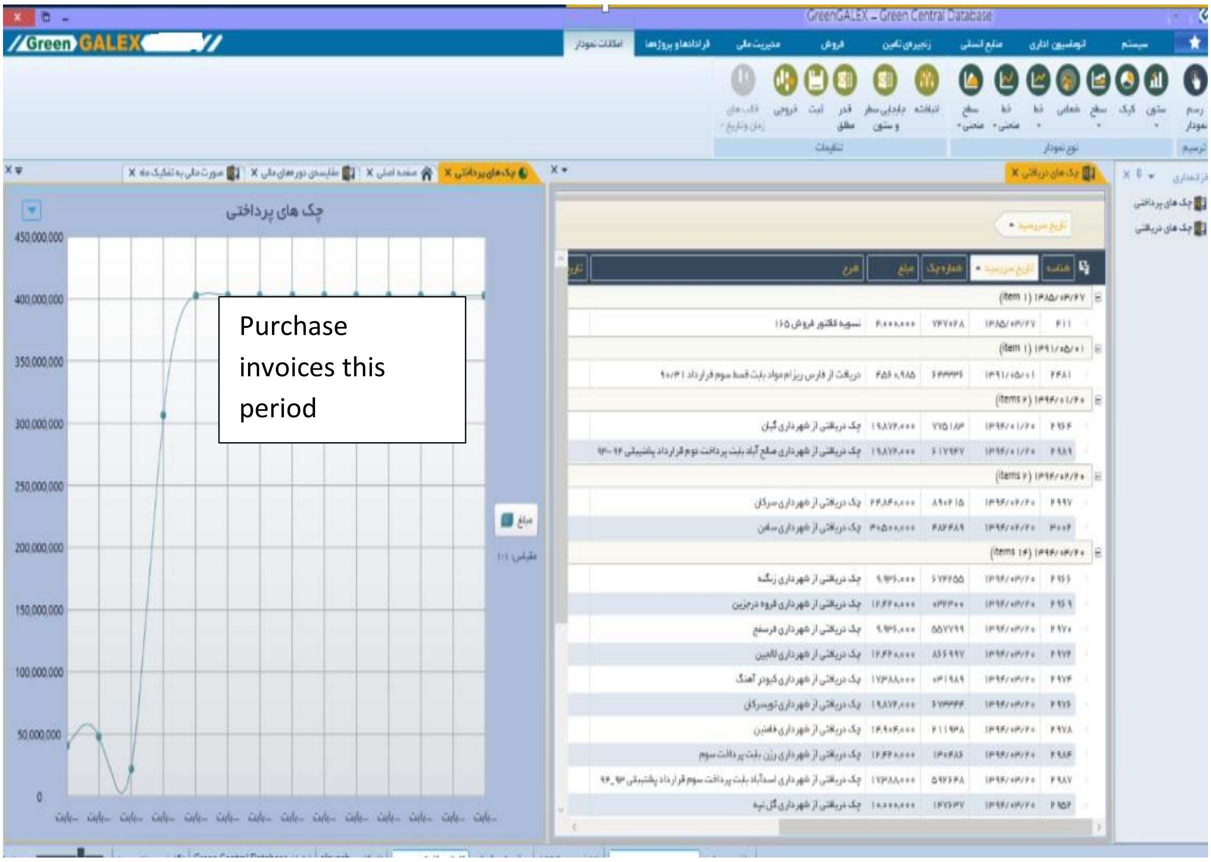


Figure 25: GREEN/ GALAX Finance Report

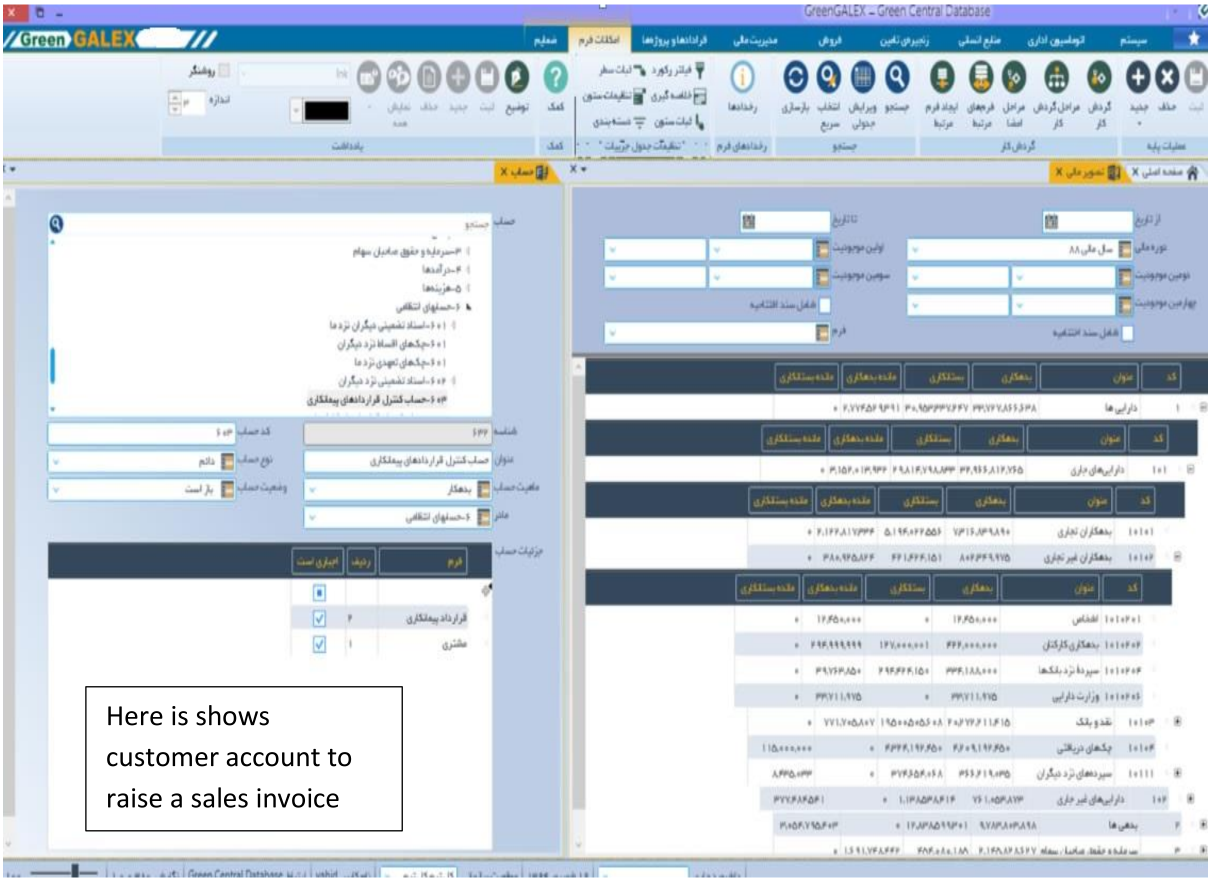


Figure 26: ETS GREEN/GALAX Finance Module Interface

Figure 26, above, (documentary evidence) shows how ETS raises the invoices; the figure shows customer code, invoice address, date, and number, and preview charges such as total charge. Finance users have visibility of unvoiced receipts, or the customer has returned goods.

Commercial

The commercial management process has two sub-processes: customer management and supplier management – and both are supported by the GREEN/GALAX commercial management module. This module supports the categorization and management of both customers and suppliers, and recording of relevant details. There is a large overlap between sales and purchasing in the GREEN/GALAX software. For example, in the purchase order, users can chase and progress their orders in details of purchase orders.

Human Resources

The human resource management process covers personnel management, including employee records, staff absence and leave, and timesheets. The process is mainly manual. Employees have their own identity and attendance card, which are checked and monitored by security guards at the company entrance. Annual leave is also authorised and recorded by a manual, paper-based system.

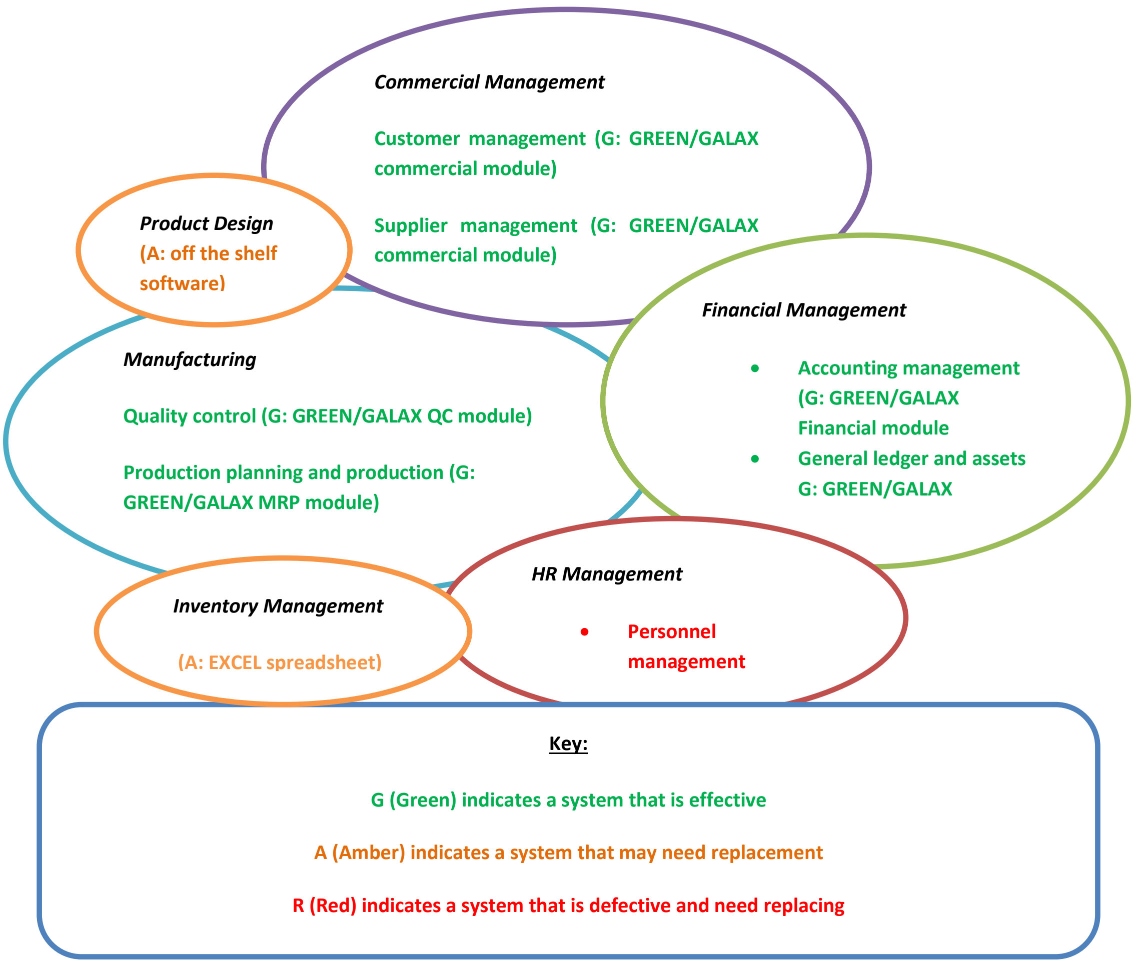


Figure 27: Main Business Processes and IS Profiling in ETS

The information system strategy adopted at ETS is based on the GREEN/GALAX ERP Package, combined with point solutions developed in MS (Figure 28, below).

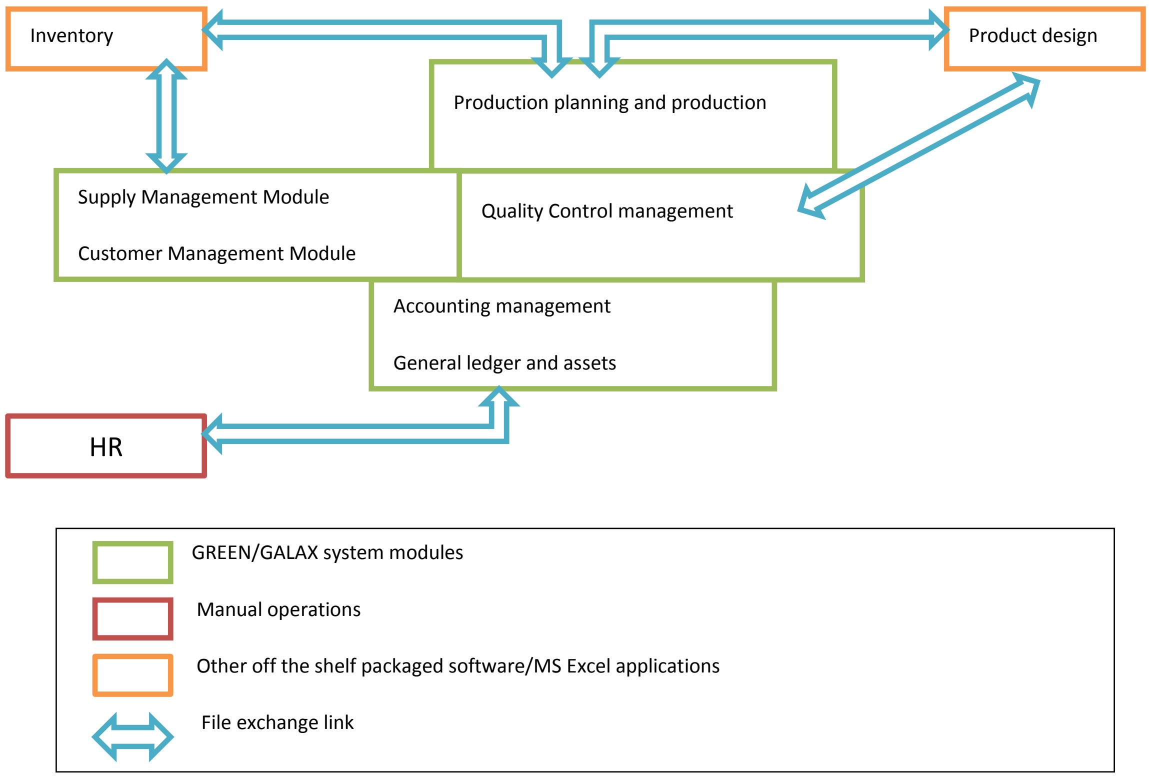


Figure 28: System Interface in Company ETS

5.4.4 Pre-Implementation Phase

5.4.4.1 Rational for ERP/Pre- Existing Systems and Technology

The company's 2013 business plan included proposals to automate processes across the company, but in particular, in the key process areas of production planning and finance. This was causing major problems in effectively scheduling and production planning which also had a direct effect on delivery and distribution. Moreover, there was a clear need to increase profitability, track and control costs. The management information in all areas of the company was processed by Microsoft package and a range of spreadsheets (Table 23, below). There was a dire lack of management information and process integration: as a result, it proved very difficult to get accurate consistent information from the existing system. As the company developed products, the need to integrate processes came to the fore and led to the election of an ERP solution. Head of IT stated that lack of consistency, and duplication in all processes led to inefficient performance and loss of business time. Company was also open to a risk of data loss as there was no back up plan and policy in place. So, in the eventuality of data corruption, there would not be a restore point.

Process	Modules	Users	Pcs	Server
Finance	Microsoft package (MS/ Access)	4	4	
Commercial	Microsoft package	8	8	
Distribution and stock control	Microsoft package (MS/Excel)	2	1	
Production and engineering	Microsoft package	8	7	
Human Resources	Manual	0	0	

Table 22: Systems Users in ETS before the GREEN/GALAX TOTAL/ERP Project

5.4.4.2 Package Selection

A request for proposals was sent to several vendors. A few vendors were identified that could provide the required functionality in process areas of the business at acceptable cost. All vendors presented their product to the company director, IT admin, and head of departments in 2014. The formal decision made by the company director in conjunction with the Head of IT , the head of departments and software provider consultants. The choice of the main software system again influenced by the fact that it was available in the Parsi language and there was easy access to software support and technical advisors.

5.4.5 Implementation Phase

5.4.5.1 Module Implementation History and Process

The information system strategy adopted at ETS is based on the GREEN/GALAX Total systems package, combined with point solutions developed in MS Excel. The Strategy was formal decision made by company director. Modules of the GREEN/GALAX were implemented simultaneously in core business functions. Figure 29, below, (documentary evidence) illustrates GREEN/GALAX activities. Unfortunately, training was poor and insufficient and there have been significant user issues with some departments reverting to previous semi-manual processes. There also remain a number of file exchange operations whereby data is extracted from the GREEN/GALAX system and input into standalone applications for inventory management and product design. The director of the company wanted a quick implementation, so enough time was not allocated for training. Users did not clearly understand the new system and as such they were not satisfied and resisted using the new system. Therefore, in 2015 external consultants were engaged to review the status of the ERP project and specifically to provide training and user support.

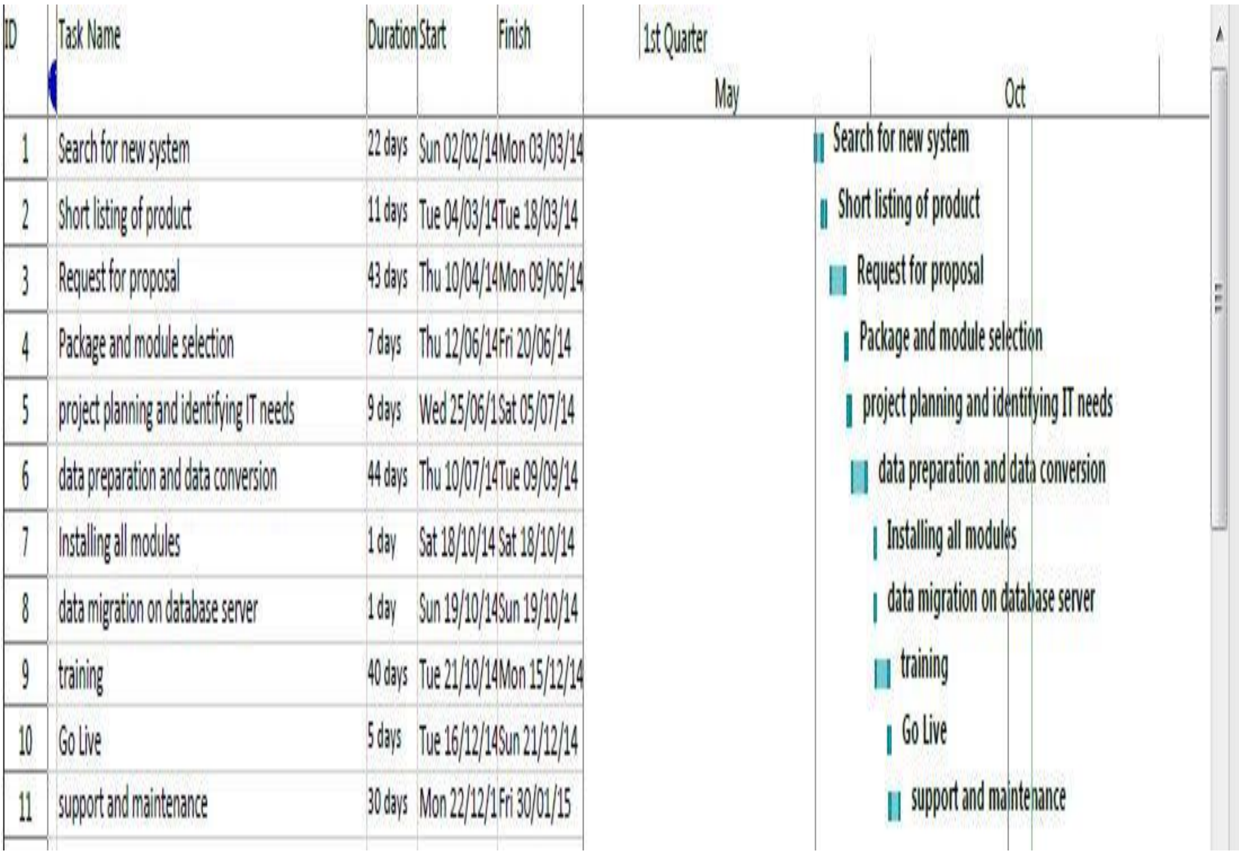


Figure 29: ETS Gantt Chart

5.4.5.2 Technology Infrastructure Development

The ETS Company does not have a separate IT department. They only have one Head of IT and a database administrator in the commercial department. The Head of IT has a BA in computer science. ETS has two servers including database server and webserver. The company has two servers including a database server and a webserver (see Figure 30, below, documentary evidence). Windows 2012 R2 are installed on all the servers. Microsoft SQL 2008 installed on database server, and also database back up is scheduled on this server along with offsite back up. GREEN/ GALAX modules, website and email run on the webserver. Wired and wireless Internet access is installed in ETS. They had 25 desktop computers that were available to 27 and more users (see Table 24, below). ETS provided three portable devices (laptop) if they need it for out of the site mission, or presentations and meetings. All PCs run by Windows 10 operating system and MS office, and necessary licensed packages such as anti-virus software. The GREEN/GALAX system is developed in C++ and uses the Microsoft SQL 2008. GREEN/GALAX system has a drop list that enables the user to choose which subsystem based on their department to login. All users including staff and students log onto the system with personalised user ids and strong passwords with different accesses and privilege. Head of each department can grant other users with extra or less permission. All modules administered by head of each department who have access to all reports and invoices. The whole system is controlled, maintained, and upgraded by database administrator (DBA).

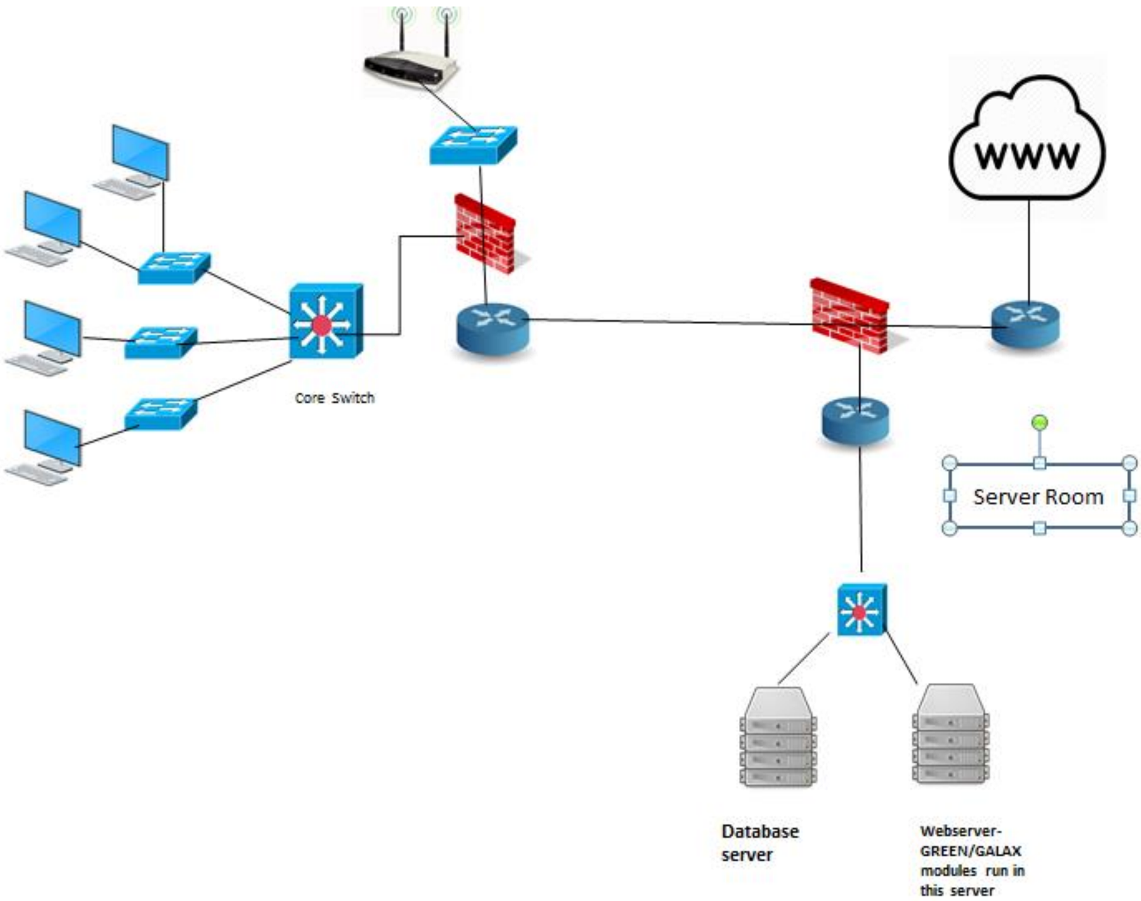


Figure 30: Network Infrastructure in ETS

Process	Green/Galax Modules	Main USERS	PCs (desktop)
Commercial	Customer management Supplier management	8	8
Financial	Accounting management General ledger and assets	4	4
Manufacturing	Quality control Production planning Production and assembly	8	7
Product design	off the shelf software	5	5
Inventory	EXCEL spreadsheet	2	1
HR	Manual	0	0

Table 23: GREEN/ GALAX Modules and Number of Users

5.4.5.3 Process Change and People Aspects

Implementing GREEN/GALAX modules involved changes in existing processes. Financial, manufacturing and commercial processes are automated by GREEN/GALAX. All three processes are integrated. Manufacturing processes in previous system was spreadsheet contains: the delivery day, customer details, and orders details, while in current system is automated (Figure 31, below, documentary evidence). However, because the processes are automated, there is not a huge difference in user and responsibilities, company mostly keep the previous users in most automated areas. Due to an insufficient budget, the company did not provide actual training for all users.

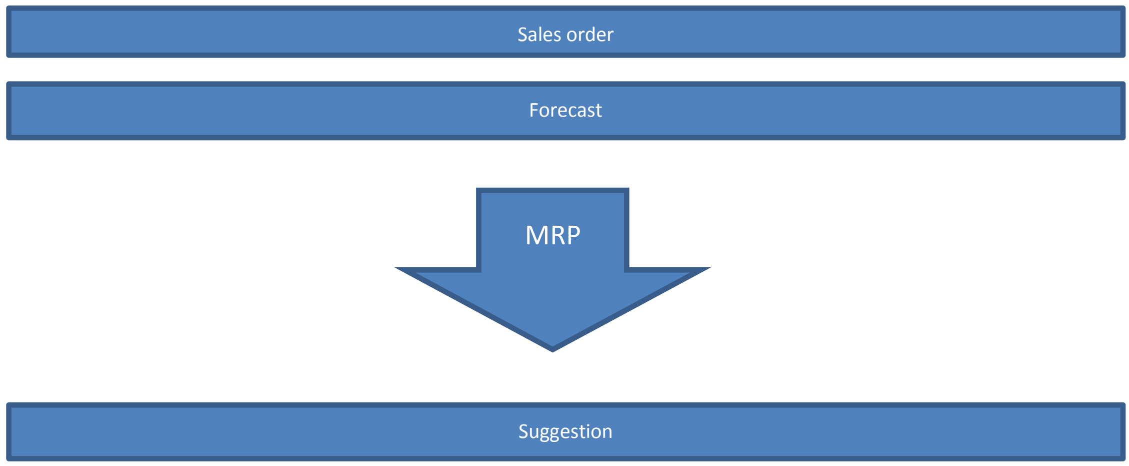


Figure 31: MRP and Production Planning in ETS

5.4.6 Post Implementation

5.4.6.1 On-Going Maintenance and Upgrade

Since 2014 that GREEN/GALAX has been implemented, company has not upgraded the system. Unfortunately, because vendor was located in another city, they did not support the maintenance. Therefore, company had been using a third party consultant since March 2015, for functions including database administrator support and administrate modules.

5.4.6.2 Project Costs and Benefits

The project cost nearly 150 million Toman, which is equal to £30,000. According to the HR Manager, the company did not really enjoy the benefit of the system due to the lack of training and system misuse. Head of IT asserted that they have not measure of GREEN/GALAX benefits and there is different viewpoint among the users regarding the benefits of the system.

5.4.6.3 Process Improvement and People Change Issues

The GREEN/GALAX improved the company business processes. All three modules are integrated very well. The company performance increased in manufacturing, sales and marketing, and finance. Company needs to automate HR process. HR process is paper-based system, which negatively affects many processes such as finance. HR manager asserted that there is lack of accuracy and efficacy in this process such as employee's absence or leaves. Company director stated that we saved so much money and time in printing. Due to the lack of training ETS struggled with user's issues such as resistance to using the system for up to two months.

5.4.7 Summary

The GREEN/GALAX Total package went live at ETS in 2014, and the business functions of production planning and production, and financial were managed, albeit briefly, via the new system. The HR system needs to be automated and integrated with finance and the accounting department to prevent duplication and data inconsistencies in payroll. Similarly, the inventory system needs to be automated to enhance the capability and functionality of company business activities. This will help MRP to compare the demand with level of stock and raise the purchase order. The company needs to address the training issue to encourage and support staff in using all of the available functions in the new system.

ETS IT Advisor stated that GREEN/GALAX implementation was not as successful as they expected; however, it benefited many aspects in business area. For example, there is visibility of reports in the system and there is no need to print. In addition, the data in system was more up-to-date; for instance, it was possible to access customer reports and supplier reports in real time. Furthermore, he claimed that not having a skilful project manager and project team, IT infrastructure, and lack of training for main users affected success of the project. HR manger also reiterated the similar views as the IT advisor, stating the implementation of new modules had not been adequately coordinated with changes in people capability.

5.5 *Case Study 3: Spare Part Company (SPC)*

5.5.1 SPC Background

The Spare Part Company is located to the south of Tehran and occupies a site of 40,000 m2, including 25,000 m2 of the production building space in the industrial city of Isfahan province. The company was founded in 1988 as a family business based on auto body parts manufacturing, moulding, and production. The company was registered in early 1988, currently employs 250 staff and designs, manufactures and sells a range of spare parts. SPC has one main site and all company employees work on the company's main site in Tehran.

5.5.2 SPC Questionnaire Respondents and interviewees

The data from SPC has been collected through questionnaires, interviews, and documentary evidence. In SPC a detailed structured questionnaire filled in by five respondents, and follow up interviews have been conducted with same respondents. Table 24 provides an overview of respondent's job role and their involvement in the recent IS implementation project:

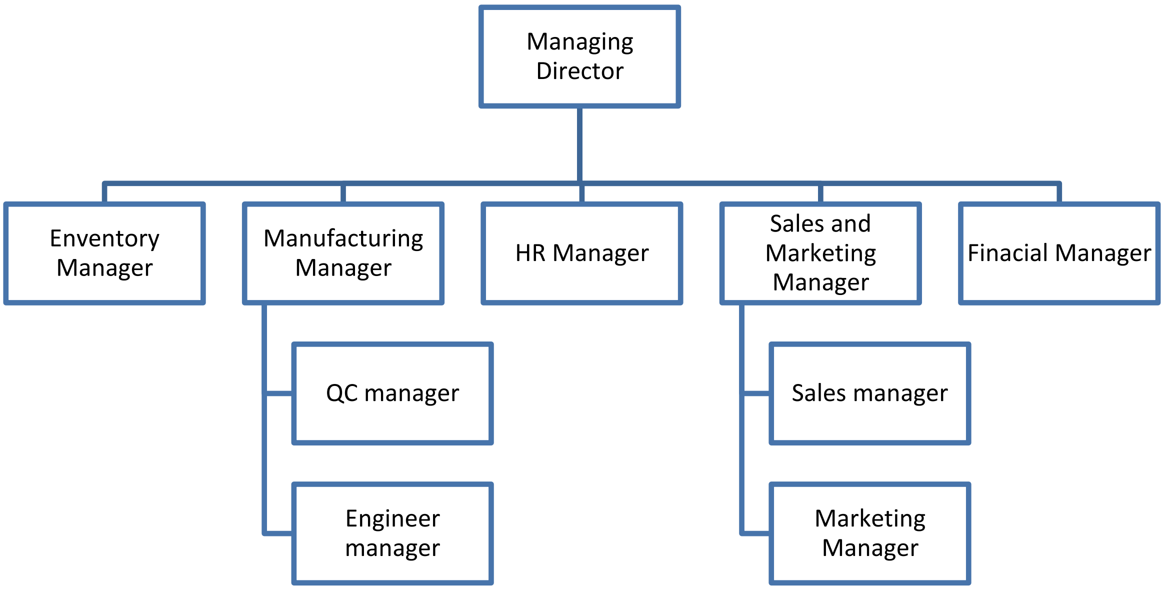
Respondent position	HAMKARAN project involvement
Head of the Quality Control (R1)	He was on the project team that was responsible for selecting and implementing the Total Systems solution.
Head of Finance (R2)	He was on the project team that was responsible for administrating and supervising the financial management of implementing the financial module of Total Systems solution.
Head of IT (R3)	Involved in supporting main departments in specifying their requirements and in charge of project team. He was involved in package selection and all implementation phase.
Head of Sales and Marketing (R4)	He worked closely with the Head of IT in the selection and implementation processes, identifying and planning training for most of the staff.
Head of Production (R5)	He was involved in the software selection process and played an important role in post implementation in reviewing and proposing training needs for new systems users.

Table 24: SPC Respondent

5.5.3 SPC structure, Processes and Current System Deployment

The SPC has the following departments: Finance, Human Resources, Production and Shop Floor, Procurement and Logistics and Sales and Marketing. According to the respondents, the company overall business strategy was to manufacture high quality products, reduce the cost of production, improve customer satisfaction and increase sales. The Head of Production stated that in today's competitive market, poor quality of products leads to loss of customers. He emphasised the essence of providing high quality standards and minimising manufacturing cost (section 1, question 9). Figure 32, below (documentary evidence) illustrates organisation chart in SPC.

Figure 32: SPC Organisation Chart



The Head of quality control asserted that company aims to check and review products every two weeks either through physical test or visual inspections (section 1, question 9). The Head of Sales and Marketing also underlined the importance of customer service satisfaction and high quality standard in products (section 1, question 9). Head of Finance and IT accentuated the same objectives (section 1, question 9).

5.5.3.1 SPC processes and sub- processes

Initial process mapping suggests there are five top-level business processes, and each process has several sub-processes. The processes are depicted in Figure 31, along with the information systems that currently supported these business processes.

Manufacturing and operation

The manufacturing process in this company comprises two sub-processes: production/production planning, and maintenance/engineering. Production and production planning are supported by HAMKARAN manufacturing and operations module. The production/production planning sub-process reacts to forecast demand to generate works orders and procurement requirements to meet those orders. Users are also able to specify cumulative lead times they want to allow for order fulfilment, and also record human resource availability patterns for production. Users also record quality inspection details and outcomes across the internal supply chain from component parts to finished products. The maintenance and engineering sub-process, however, is only partly automated, with Microsoft Excel spreadsheets.

Sales and Marketing

The sales and marketing process is automated and supported by the HAMKARAN sales and marketing modules. This allows data entry and recording of relevant details for prospects and customers, price lists, and quotations, and reporting and tracking of sales orders, despatches and outstanding invoices, and the monitoring of credit control status of customers and sales performance. The sales team can change product prices and apply discount for specific customers or products.

Financial Management

The Financial process is automated using the HAMKARAN finance and accounting module, which is closely integrated with the other HAMKARAN module. The financial and accounting module is used to prepare financial reports in compliance with Iranian accounting standards and international financial regulations. Standard reports are available from the general ledger, account payable, and account receivable HAMKARAN finical module reports the general ledger, account payable, and account receivable, including evaluation of payment and cash discount histories.

Human Resources Management

The human resources process has two sub-processes including, employee administration, which is automated with HAMKARAN HR module, and Training and personnel development, which remains a manually recorded operation. The HR module includes full employee records, payment details, holiday and absence recording and payslip generation. It also has a full payroll function that integrates with production time records.

Procurement and logistics

The procurement and logistics process encompasses inventory, purchasing and distribution management, which are integrated and automated via the HAMKARAN procurement and logistics module. Once a works order is raised and MRP calculated requirements based on available stock, a procurement request is processed through the HAMKARAN procurement and logistics module to produce purchase requisitions and purchase orders. This module also has functionality to support both inward and outward distribution, generating reports of expected deliveries against customer orders, and also reporting on finished product distribution.

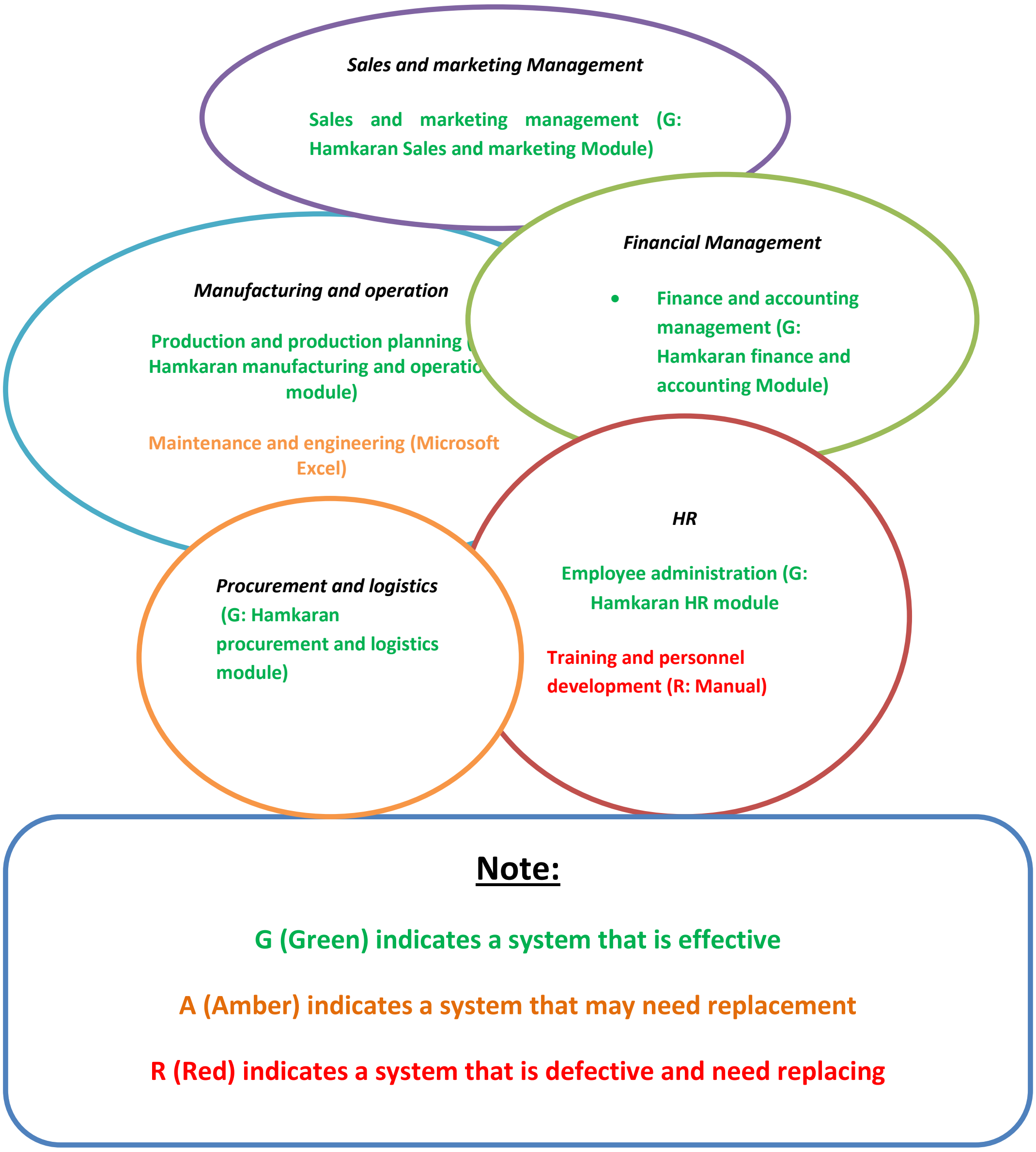


Figure 33: Main Business process and IS Profiling in Company SPC

The information system strategy adopted at SPC was based around the phased introduction of the HAMKARAN ERP system. HAMKARAN is an Iranian product and the selection was again influenced by language (it uses Parsi), and availability of the Persian calendar within the system. Another factor that influenced software selection was ease of access to the software company for software maintenance or upgrade. SPC elected to pursue a phase implementation to allow employees to adapt gradually to changes in their systems and ways of working. It took two years to implement the system. The HAMKARAN systems modules are integrated, but links with the Excel spreadsheet in the maintenance and engineering process is still done by file exchange (see Figure 32, below).

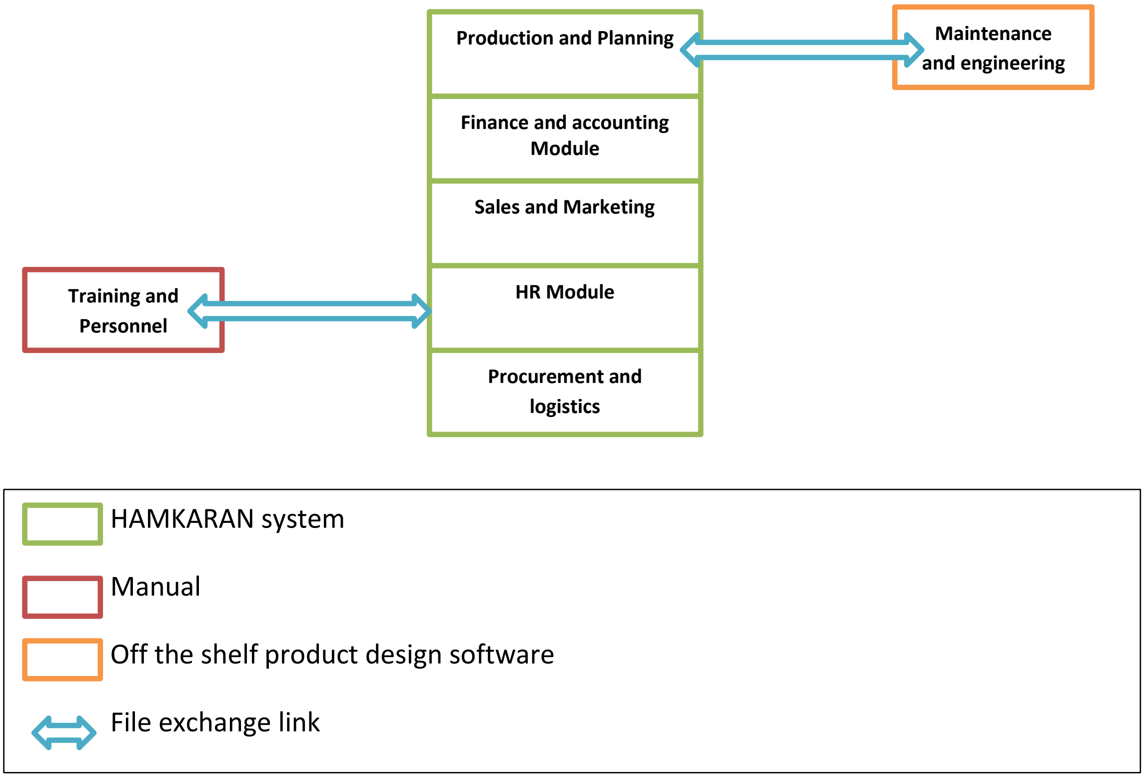


Figure 34: System Interface in SPC

5.5.4 Pre- Implementation Phase

5.5.4.1 Rational for ERP/ Pre Existing Systems and Technologies

The company's 2009 business plan set out requirements for significant growth in manufacturing high quality products at lower production costs, improving customer satisfaction and increasing sales in the subsequent five years. These requirements included automating processes across the company. The management information in all areas of the company was processed by a range of spreadsheet and Microsoft packages (Table 25, below). There was a dire lack of management information and process integration. The core processes were not integrated and it was very difficult to get precise and reliable information from existing systems. As the company aimed to develop and compete in the Iranian market, the need to integrate processes became prominent and led to the adoption of a more complete vision of different automated processes and the election of an IS solution. The Head of IT emphasised the duplication problem and risk of data loss as there was no backup plan in place.

In order to achieve company objectives and support the company business plan, SPC decided to consider an integrated package to automate company processes and re-engineer business processes. To support the company to move into one team approach, the SPC establish a joint hardware platform and associated technical standards for IS across all departments. New system needed to eliminate duplication processing, reduce the data loss, and improve the data availability.

Processes	***Modules***	***users***	***pcs***	***Servers***
Finance	Ms Access	7	5	
Sales and Marketing	Ms Excel	8	6	
Human Resources	Ms Excel	5	2	
Production and Shop Floor	Ms Excel	20	10	
Procurement and Logistics	Ms Excel	7	5	

Table 25: IT Infrastructure in SPC before HAMKARAN TOTAL System

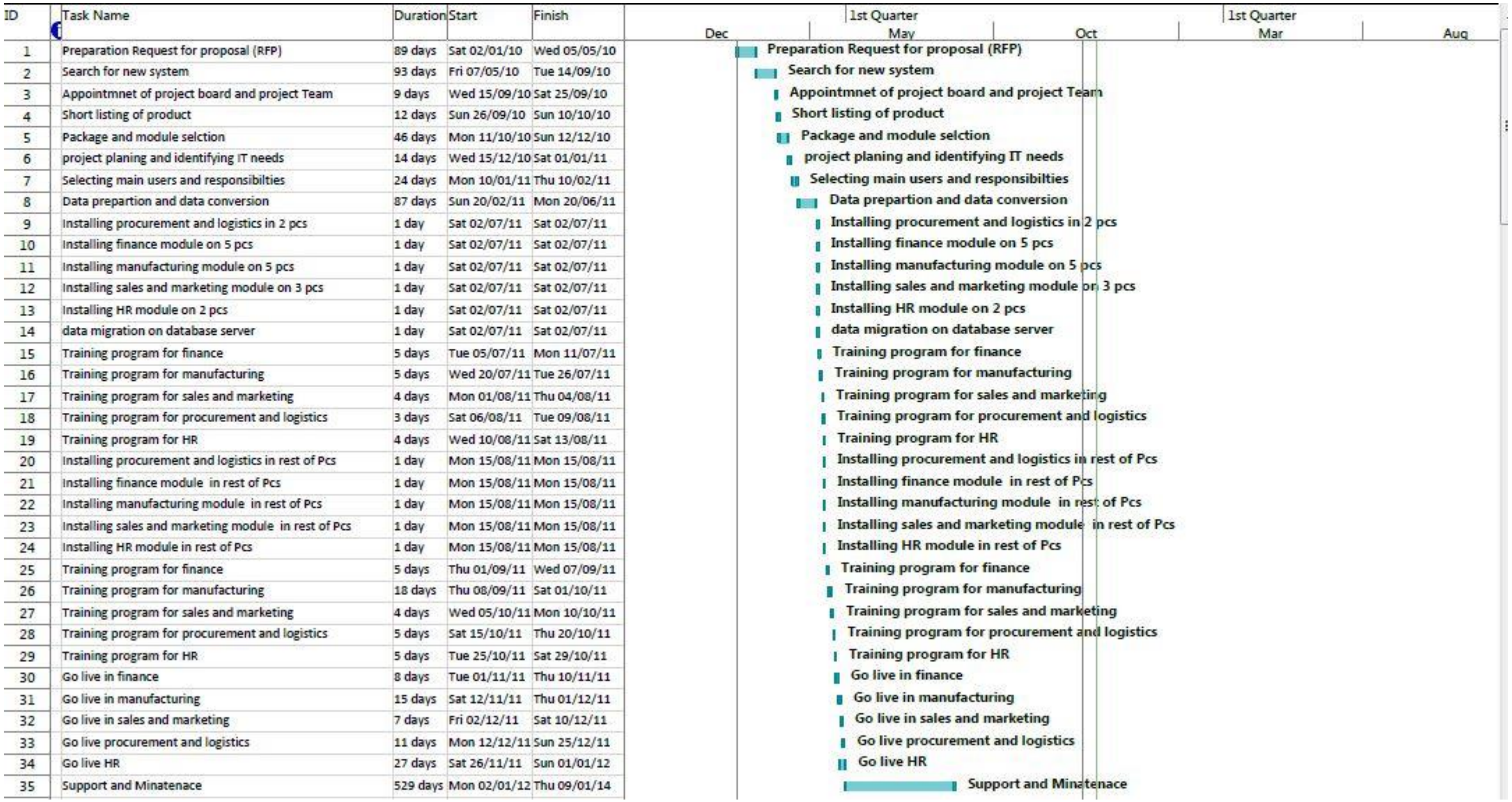
5.5.4.2 Package Selection Process

Selecting a right IS package, with best fit to company requirements, is crucial to overall project success. The SPC IT manager shortlisted several products and requested workshops from each vendor. A committee comprising the heads of each department was set up and they attended the workshops. After reviewing all shortlisted packages, the committee selected the HAMKARAN TOTAL/ERP system. HAMKARAN is an Iranian Brand; the preference was again, like the other cases, based on languages (using Parsi), and easy access to the company for maintenance or upgrade.

5.5.5 Implementation Phase

5.5.5.1 Module Implementation History and Process

The implementation strategy was a formal decision made by project team. The strategy was a stage-by-stage implementation of the HAMKARAN system, and a gradual replacement of previous off the shelf systems. All modules were installed simultaneously in 2011 on a few desktop computers and the database server, and some key users were trained up in the use of the system, systems modules were then installed on the other desktops and users trained accordingly. Only then were some users put live, but this was done in phases and followed the order of the training programme. The financial systems users were first to use the new system, followed by manufacturing process users, sales and marketing, procurement and logistics, and finally human resources users. Overall, this roll-out and move to ‘go live’ took four months in the period November 2011 to February 2012 (see Figure 35, below, documentary evidence).



ID	Task Name	Duration	Start	Finish
1	Preparation Request for proposal (RFP)	89 days	Sat 02/01/10	Wed 05/05/10
2	Search for new system	93 days	Fri 07/05/10	Tue 14/09/10
3	Appointmnet of project board and project Team	9 days	Wed 15/09/10	Sat 25/09/10
4	Short listing of product	12 days	Sun 26/09/10	Sun 10/10/10
5	Package and module selction	46 days	Mon 11/10/10	Sun 12/12/10
6	project planing and identifying IT needs	14 days	Wed 15/12/10	Sat 01/01/11
7	Selecting main users and responsibilties	24 days	Mon 10/01/11	Thu 10/02/11
8	Data prepartion and data conversion	87 days	Sun 20/02/11	Mon 20/06/11
9	Installing procurement and logistics in 2 pcs	1 day	Sat 02/07/11	Sat 02/07/11
10	Installing finance module on 5 pcs	1 day	Sat 02/07/11	Sat 02/07/11
11	Installing manufacturing module on 5 pcs	1 day	Sat 02/07/11	Sat 02/07/11
12	Installing sales and marketing module on 3 pcs	1 day	Sat 02/07/11	Sat 02/07/11
13	Installing HR module on 2 pcs	1 day	Sat 02/07/11	Sat 02/07/11
14	data migration on database server	1 day	Sat 02/07/11	Sat 02/07/11
15	Training program for finance	5 days	Tue 05/07/11	Mon 11/07/11
16	Training program for manufacturing	5 days	Wed 20/07/11	Tue 26/07/11
17	Training program for sales and marketing	4 days	Mon 01/08/11	Thu 04/08/11
18	Training program for procurement and logistics	3 days	Sat 06/08/11	Tue 09/08/11
19	Training program for HR	4 days	Wed 10/08/11	Sat 13/08/11
20	Installing procurement and logistics in rest of Pcs	1 day	Mon 15/08/11	Mon 15/08/11
21	Installing finance module in rest of Pcs	1 day	Mon 15/08/11	Mon 15/08/11
22	Installing manufacturing module in rest of Pcs	1 day	Mon 15/08/11	Mon 15/08/11
23	Installing sales and marketing module in rest of Pcs	1 day	Mon 15/08/11	Mon 15/08/11
24	Installing HR module in rest of Pcs	1 day	Mon 15/08/11	Mon 15/08/11
25	Training program for finance	5 days	Thu 01/09/11	Wed 07/09/11
26	Training program for manufacturing	18 days	Thu 08/09/11	Sat 01/10/11
27	Training program for sales and marketing	4 days	Wed 05/10/11	Mon 10/10/11
28	Training program for procurement and logistics	5 days	Sat 15/10/11	Thu 20/10/11
29	Training program for HR	5 days	Tue 25/10/11	Sat 29/10/11
30	Go live in finance	8 days	Tue 01/11/11	Thu 10/11/11
31	Go live in manufacturing	15 days	Sat 12/11/11	Thu 01/12/11
32	Go live in sales and marketing	7 days	Fri 02/12/11	Sat 10/12/11
33	Go live procurement and logistics	11 days	Mon 12/12/11	Sun 25/12/11
34	Go live HR	27 days	Sat 26/11/11	Sun 01/01/12
35	Support and Minatenace	529 days	Mon 02/01/12	Thu 09/01/14

Figure 35: SPC Gantt Chart

5.5.5.2 Technology Infrastructure Development

The IT office is located in the human resources department and consists of two full time IT staff, those being the IT manager and database administrator (DBA). Both of them had a BSc in computer science and good knowledge of the Oracle database and had been with SPC from 2009. The database administrator had good knowledge in systems analysis and the C++ programing language. SPC has four servers including database, software (modules of HAMKARAN system), web and email server, and backup server (see Figure 36, below, documentary evidence). Windows 2012 R2 is installed on all servers. Microsoft SQL was installed on the database server. HAMKARAN modules had been installed on the software server. The company email and website were hosted on the webserver. Lastly, the backup server was used for archiving company data and the IT manager backs up the data from various servers on a weekly basis.

Network connections installed in SPC are both wireless and cable. All departments are connected via LAN Network. All users have their own specific privileges which determined by head of department. The privileges and accesses for head of departments are authorised by company director. If any users reach the maximum unsuccessful attempts log on, the session automatically terminated and triggered block user.

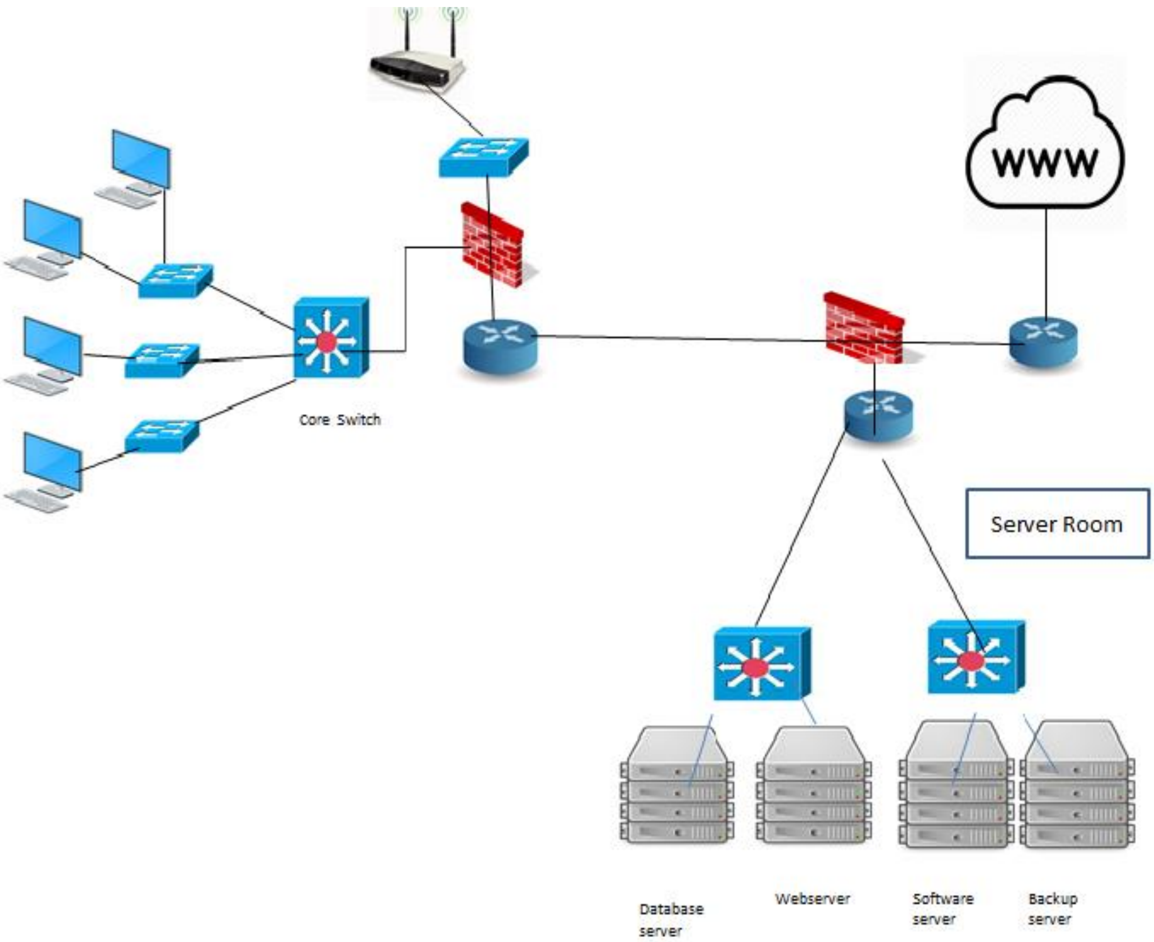


Figure 36: Network Infrastructure in SPC

SPC provided 50 desktops for 50 users, besides three portable devices (two laptops and an IPad) for out of the site mission, presentation, or meetings (see Table 26, below). All computers run windows 10 operating system and MS office. The HAMKARAN systems uses mainstream technologies, having been developed in C++ and uses the Microsoft SQL server database. Users are only able to login in their own subsystem. So as mentioned earlier all users have their own personalised log on details with specific access and privileges. The head of each department have control on their own department user's access and can grant them with different access. The database administrator is responsible to control, maintain and upgrade the system.

Process and sub process	HAMKARAN modules	Main Users	PCs
Sales and marketing Management	HAMKARAN Sales and marketing module	8	8
Financial Management	HAMKARAN finance and accounting module	7	7
Procurement and logistics	HAMKARAN procurement and logistics module	7	7
Manufacturing and operation	HAMKARAN manufacturing and operation module		
Maintenance and engineering	Microsoft Excel		
HR	HAMKARAN HR module	5	5
Training and personnel development	Manual	3	3

Table 26: HAMKARAN Modules and Number of Users

5.5.5.3 Process change and People Aspects

Implementing the Hamkaran modules involved major changes in company business processes and people aspects. Most of the company processes needed to be automated, especially in the Production and Shop Floor departments. The Hamkaran system supports sales and marketing, financial, procurement and logistics, manufacturing and operation, and HR processes. Figure 37, below (documentary evidence); illustrate HAMKARAN MRP and production planning process. Project team had been responsible to communicate clearly and involve the main users in the whole implementation change process, explain the scope of the project to users. All the main elements of the new systems project were adequately explained to all users prior to the start of implementation. The Head of IT and database administrator had regular meetings with head of departments and company director to check and report the implementation progress. The training was planned stage by stage. The initial training targeted only heads of departments as system owners who were familiar with their respective department processes. The next stage was to train key users who had sufficient knowledge and IT skills. The final stage targeted the rest of the main users. The training for each department focused on its respective module and how to use the system to complete a task.

During the final adjustment, all users were trained on various modules of the system. The training programme was in both face to face and also e-learning, also further training was arranged for new users.

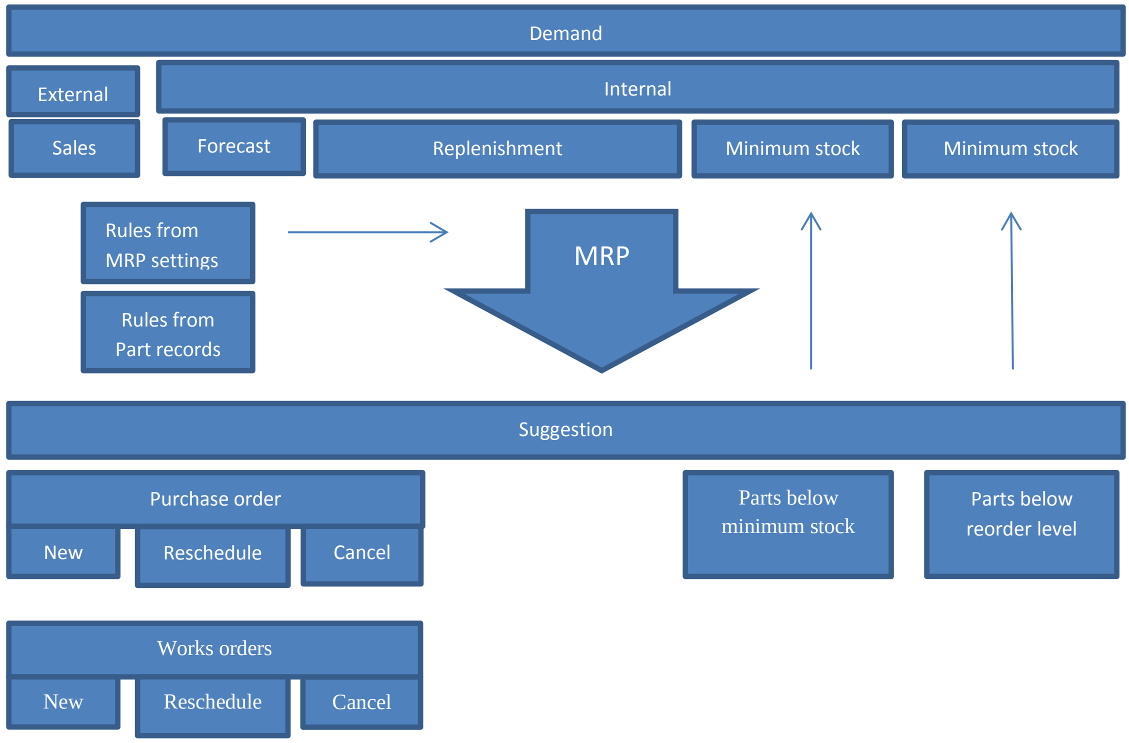


Figure 37: MRP and Production Planning in SPC

5.5.6 Post Implementation Phase

5.5.6.1 On-Going Maintenance and Upgrade

The software vendor's support for the company in terms of maintenance during the implementation processes finished in 2012, as agreed before implementation. The agreement for support ended of 2014. SPC's ERP system had not been upgraded since 2012, and the company had no plan to upgrade at time of data collection due the lack of financial resources.

5.5.6.2 Project Costs and Benefits

Since the HAMKARAN system has been implemented the business achieved enormous benefits. Automating the processes such as manufacturing and finance, procurement, sales and marketing affect the company performance and improved data quality in all processes. The implementation of HAMKARAN was to support sales and marketing and provide better services to its customers. Company uses most of the functionalities of the system. One of the benefits mentioned by the head of finance was the visibility of finance reports. He asserted that we had to spend too much time to provide a report. Other benefits that were mentioned repeatedly were data efficacy in inventory system. The project cost 300 million Toman, equal to £75,000.

5.5.6.3 Process Improvement and People Change Issues

There had been major changes in the way processes worked since the company implemented HAMKARAN. All processes are automated. The company and users all are satisfy with the system. Regarding the job descriptions and roles, company did not change any main users; however, they recruit some new employees for some new positions. The Head of IT asserted that however the performance is better and more accurate; the company financial performance was still lagging behind due the tight competition and also inflation in the country.

5.5.7 Summary

The information system strategy adopted at SPC mostly focused on the HAMKARAN ERP system, which was adopted in 2010 to support the company business strategy and increase the company production. SPC is planning to automate all manual processes and sub processes, which include replacing manual and standalone application such as training and engineering sub processes. The implementation process took two years and can be viewed as a successful implementation as the three elements of change (people, process, and technology) improved gradually and stayed balanced. SPC IT manager stated that it was huge risk to move on toward ERP as the company had to spend lots of money and time. He emphasised on essence of having project team. He also mentioned that a result of a survey in the company shows most of the users are satisfied and feel comfortable to use the system. The Head of finance stated that the company achieved its objectives.

5.6 Conclusion

The current information system strategies at IBC, ETS and SPC have some similarities. All three companies elected to adopt a “Total Solutions” package, from Iranian based software suppliers, to provide the benefits of integrated systems and consistent management information to support company growth aspirations. In all three companies, however, some of the old legacy systems remained in some core process areas and these should be replaced in the near future with appropriate Total Systems modules.

There were significant differences between the three companies’ strategy implementation approaches. At IBC, the strategy development and its implementation was agreed to and guided by a cross-departmental steering group that carefully managed a staged implementation, providing the necessary training support for end-users. At ETS, the package selection process was more the result of discussions between the IT manager, company director, and head of departments. There were a lacked cross-company involvement and support. Simultaneous implementation increased the risk of systems problems and data issues. This was compounded by the absence of adequate training and support for end-users, which left the project in a parlous state. Only recently has the engagement of third party support helped to provide much needed training and bed in the new systems modules. At SPC, the strategy development and its implementation was agreed to and guided by a project team that carefully managed a staged implementation, providing the necessary training support for end-users.

Chapter 6: Analysis and Evaluation

6.1 Introduction

This chapter presents data analysis and interpretations of findings from the survey, questionnaire and interviews discussed in chapter five. This chapter has six sections, including an introduction to the chapter, and an analysis of survey findings to understand the extent of ERP systems implementation in Iranian SMEs. There follows an analysis of the findings from the three case studies to gain a richer understanding of the nature of ERP implementation, how the systems have been used and the degree of success that has been achieved. The analysis follows the phases and change elements that were presented in chapter three as the conceptual framework. Finally, a conclusion is presented.

6.2 ERP Implementation in Iranian SMEs: Survey Analysis

Survey findings reveal that there is a development in emerging integrated software solutions developed in Iran, by and large for the home business (see Table 28, below). These are sometimes called "total solutions," being produced and sold by Iranian software companies. The term "ERP" is also used, but these products are usually more customisable to specific user requirements and are also available in the Parsi language. The sanctions on trade with the West have further encouraged Iranian companies to look inside their country for integrated software solutions (Rezaeian & Wynn, 2016). Furthermore, as stated by respondents in the initial survey and follow-up interviews, Iranian SMEs prefer domestic ERP packages due to issues such as language, use of the Persian calendar, and affordable pricing.

BEHKO	http://www.behko.com/?page_id=96
GREEN GALAX	http://www.greendataware.com/about/history/
PARS ROYAL	http://parsroyal.net/products
MEDAR GOSTARESH	http://www.itorbit.net/
HAMKARAN SYSTEM	http://www.systemgroup.net/products/%D8%B1%D8%A7%D9%87%DA%A9%D8%A7%D8%B1-%D8%AF%D9%88%D9%84%D8%AA
RAYDANA SYSTEM	http://www.danabarcode.com/
EADEGOSTAR	http://ideagostarco.net/Page/About
EADEPARDA ZAN	http://www.eadepardazan.com/pages/ltr/LTRDefault.aspx?pid=2&lang=2
RAYVARZ	https://rayvarz.com/about-us
FARAGOSTAR	http://www.faragostar.net/automation/
PARNIAN PARDAZESH PARS	http://www.parnianportal.com/OA/Pages/Home.aspx
BARID SAMANEYE NOVIN	http://www.baridsoft.ir/products/integrated-approach/office-automation

Table 27: Most Popular Domestic ERP and "Total Systems" Packages in Iran

6.3 Analysis of Case Studies Based on the Three Change Dimensions

This section analyses the data gathering for the case studies, and the discussion centres on the three ERP implementation phases and associated elements of change listed within the conceptual model (see Figure 9, Chapter 3). In each stage of implementation, elements of change are categorised into the Technology, People and Process dimensions. For the purposes of this research, ERP implementation is divided into the following three stages as outlined in the conceptual model:

• **Pre-Implementation Phase**: to prepare, select and plan the implementation requirements

• **Implementation Phase**: to complete the implementation and Go live

• **Post-Implementation Phase**: to maintain, support and upgrade the ERP system

It is imperative that all three change dimensions are implemented in each phase.

As mentioned in chapter three, there are many models in the literature such as Zuboff's Automate, Informate, Transformate Model (1998), the People Capability Maturity Model (Curtis *et al.*, 2001), the Stages of Growth Model (Nolan, 1979), the Process Maturity Model and many others that have been designed to evaluate information system adoption in developed countries. For the purposes of this research, the researcher builds upon the Stages of Growth Model to assess technology change, the People Capability Maturity Model to assess people change, and the Automate, Informate, Transformate Model and Process Maturity Model to assess process change in three case studies to support the analysis. The case study analysis comprised three cases. A summary of findings is shown in Table 28, below.

Case study	***IBC***	***ETS***	***SPC***
Industry	Automotive manufacturer	Automotive manufacturer	Automotive manufacturer
No. of employees	350	160	250
Ownership	Private	Private	Private
Reported turnover	N/A	N/A	N/A
ERP Implementation start date	2008	2014	2010
ERP package	BEHKO	GREEN/GALAX	HAMKARAN
ERP Drivers	Competition improve inventory management	Competition	Competition Improve customer services
Selected Modules	Finance, inventory, manufacturing, sales and marketing, logistics and distribution, HR	Finance, manufacturing, sales and marketing	Finance, Procurement and logistics manufacturing, sales and marketing, HR
Implementation strategy	Phased implementation with light customisation	Big Bang	Phased implementation

Project cost	£50,000	£30,000	£75,000
Choice of package selection	Language, Persian calendar, accessibility to software provider (local)	Language Persian calendar,	Language, Persian calendar, accessibility to software provider (local)
Implementation team	Project board, project team, software provider consultant and vendor project manager	Software provider consultant, IT admin, and company director	Project Team, Software provider consultant, project manager
challenges	Financial constraint	Financial constraint	Financial constraint
Upgrade and support	None	None	None

Table 28: Overview of Case Studies Findings

6.3.1 IBC Analysis

6.3.1.1 Pre- Implementation Phase

Technology

- ***IT Infrastructure***

Given that IBC operated only in one site, there was only a need to link the various departments within the organisation. IBC had two main buildings and provided a wide area network (WAN) to connect all computers and network devices in both buildings. In addition, IBC had recognised the need to provide more servers and computers for the new project. Total costs of this were added to the implementation cost (equivalent to £50,000). In the interview responses, IBC's Head of IT claimed that providing more servers in the company provided higher levels of security and privacy as IBC had only one server to manage both software and database, which was not secure. He explained that the database backup was scheduled weekly on the same server and the third party from the vendor company undertook system admin, which was not ideal, as he was not available all the time. He further stated that IBC needed to purchase more hardware that was compatible with a standard industrial environment, because the operation of heavy machinery on the shop floor affected the stability of nearby buildings. Based on the conceptual model, IBC provided appropriate technology in terms of servers and hardware, as well as networks prior to ERP project, which affected the project's success. Furthermore, literature frequently emphasises the effects that IT infrastructure has on ERP project success; for example, Akkermans and Helden (2002) identify appropriate IT resources as CSFs for ERP in developing countries.

- ***Information Reporting***

Prior to the BEHKO TOTAL system project, IBC always struggled with stock control, which affected its finance, purchase and sales departments. The researcher's reflection on IBC's questionnaire data identified that one of the main drivers behind implementing an ERP system was the inaccuracy and slowness of the company's inventory system, which affected purchasing and finance processes adversely. The Head of IT mentioned (section 2, question 10) that there were not any consistent reports available, so every year they needed to get certain members of staff to do stock checking. However, the deployment of the BEHKO module increased the consistency of information by providing the reports requested by each department. These reports included key business performance information, providing an overview of all sales, purchases, stock levels, and financial data and employee's reports. The Head of IT asserted that one of the most significant reports concerned inventory, which can be seen by finance, sales, manufacturing, and purchase. In terms of the Stages of Growth model (2.4.1.1), the adopted information systems in most of the processes regarding reporting were in or close to the integration stage, whereas other process, such as HR and logistics, were still in the control stage. This is because the IBC HR and logistics processes use Microsoft office and a series of spreadsheets, which are not integrated with IBC's ERP system (BEHKO TOTAL). This incompatibility led to a weakness in communication and many human errors in reporting. As researchers acknowledge (e.g. Nah *et al*., 2001; Noudoosbeni *et al.,* 2010; Dixit & Prakas, 2011) good communication is one of the CSFs for successful ERP implementation.

- ***Package and Module Selection***

The information system strategy adopted at IBC was to implement modules of the BEHKO total system in the core process areas of the business; at the interview stage, IBC's Head of Quality Control stated that the logistics and distribution modules were customised to meet the specific requirements of these processes. The new system was needed to reduce the amount of duplicated processing and eliminate the inconsistency in product list for order and production control. A significant improvement in the quality and availability of data had been required and this was achieved by the new system.

As explained in Chapter 5, the package selection process was based on a precise procedure, an important element of implementation according to Janson and Subramanian (1996), who state that any incompatibility between company needs and ERP package capabilities can lead to lengthy delays while modifications are made. The selected package was the best fit to IBC's requirements and supported IBC's business strategy to expand production and drive up bottom-line company profit. Getting the right ERP package with best fit to requirements can be viewed as a success factor in the overall project. Furthermore, Skok and Legge (2002) argued that ERP package selection is not just about selecting the right package, but also about choosing the right vendor for consulting and supporting throughout the project. Selecting a domestic system was not only cheaper, but also gave IBC a better opportunity for further support and consultation. Koh and Loh (2004) stress the importance of choosing an appropriate and skilful vendor and in the interviews two of the respondents (Commercial manager and Head of IT) mentioned that having a vendor of the ERP in the same city was a big advantage in addition to the skills of the vendor, while ETS did not chose a vendor in the same city and found this caused delays and inefficiencies.

- ***Data Conversion***

The researcher's reflection on the questionnaire data (section 2, question 7) suggested that the process of data conversion had been time-consuming for IBC, partly because of the time needed to codify all the parts needed for manufacturing on the manual inventory system. The Head of IT stated that in order to convert the previous data, the software provider first arranged a meeting to understand the way data needed to be used in the new system, and they then wrote a program for data conversion. The Head of IT asserted that one of the main issues during data conversion was duplication and the conversion process meant that some work was done twice. This was because of the inconsistency in the legacy system. He also specified that during data conversion the common error used to appear on the screen as failed to load, correct the data and run again. This shows that a lack of planning for data import led to wasted time and effort, as emphasised by Akkermans and Helden (2002).

- ***Customisation***

The questionnaire findings (section 2, question 8) indicated that the logistics and distribution module of the ERP was the only module customised to fit the department's needs. Then later the Head of IT asserted that the only customisation to the BEHKO package was to accommodate different steel thicknesses for different spare parts. The standard BEHKO package takes demand for a product and generates the bill of materials (BOM) to advise the purchasing, inventory and shop floor personnel; but the system could not cater for the different steel thicknesses required. This was introduced through customisation of the ERP prior to its implementation. This added considerably to project costs, but it was unavoidable. On the one hand, this shows that the company clearly understood its business processes before package selection; however, on the other hand it led to long-term problems with upgrades and maintenance, making them both more expensive. Therefore, if companies need to customise, they should confirm that they could afford the expenses going forward. In general, the literature suggests that the minimum customisation is advisable (Al-Fawaz *et al*., 2010; Tsai *et al.*, 2010).

People

- ***IT and Computer Literacy***

To manage a successful implementation and benefit from the BEHKO system, the company needed to develop the level of IT skills attained by their main users. Therefore, IBC decided to assign employees with a higher level of IT and computer literacy from each department to the BEHKO project (IBC Head of IT, questionnaire findings, section 3). IBC also advertised for one IT manager, two IT support personnel and one database administrator (section 3, question 1). This helped the training process for the company and eased the implementation process. Selecting main users with higher skills, especially in computer and IT literacy, increased the level of success of the BEHKO project because of their knowledge of company structure and needs. Although IBC tried to engage those employees who had higher computer literacy in the project of implementation, their lack of specific knowledge of BEHKO implementation delayed the project somewhat as BEHKO consultants had difficulty training the main users. However, IBC's Head of Quality Control (section3, question1) stated that the willingness of the company's IT department to learn had a major impact on smoothing the training. The Head of IT mentioned that it was more difficult to transfer knowledge to employees who had relatively low computer literacy.

Umble *et al.* (2003) argued that a lack of IT and computer literacy and skills can adversely affect a project's success. Davenport (1999) emphasised the importance of recruiting experienced and skilful employee to organisations and asserted that skilful employees are and investment for a business. Many other researchers (such as: Pfeffer, 1994; Ulrich, 1997a; Boehm, 1981 & 2000) also place emphasis on people's experience and level of skills and its effects on business and project success.

- ***Awareness of Goals and ERP Project***

The researcher's reflection on the questionnaire data (section 3) and interview findings suggested the project team was responsible for demonstrating the goals and objectives of the BEHKO project to users. The project team set up a meeting before implementing the BEHKO system with users to clearly state the goals of the BEHKO project. Understanding of the company goals and objectives helped IBC to define processes and put the company in a good position for success. In the interview, the Head of IT asserted that the understanding of the overall needs of the organisation helped IBC to direct the project in the right line. Heeks (2002) also emphasised an awareness of goals and objective for a successful outcome in IS projects in developing countries. This is in line with the conceptual model in this research. Based on the conceptual model, the findings indicate that sharing the goals and objectives of an ERP project before implementing ERP can affect the success of the project because users feel more involved in the project.

- ***Selection of Main Users and System Champions***

Questionnaire findings (section 3, question 8) and follow up interviews indicated that IBC attempted to engage its employees as much possible in the BEHKO implementation project. In order to extend the understanding and enquiries beyond the technical facets of the project for the users, IBC identified its main users and system champions before the start of the project. The project team, with the consent of the project board, identified the main users and system champions. In the interview process, the Commercial Manager noted that selecting main users allowed users to familiarise themselves with the new system and its associated procedures. Basu *et al.* (2002) assert that user and team involvement are CSFs in ERP implementation. The Commercial Manager asserted that engaging employees eased the changes in processes and that identifying main users and system champions increased the success of implementation. These assertions indicate the importance of employee's involvement in the project and how identifying the correct employees for each process can increase the level of success. Arabi *et al.* (2011), on the basis of ERP implementation in SMEs categorises selecting system champions as a critical success factor in ERP projects.

- ***Appointment of Project Board and Project Team Members***

The researcher's reflection on the questionnaire data (section 3, question 3) suggested IBC set up the project team and project board before implementation to help the project. In the interview process, the Head of IT asserted that having a project team and project board smoothed the decision making processes, helping to identify the business processes, company scope and goals. He further claimed that having a project board and project team at the beginning of the project saved a significant amount of time. The project team and project board were selected based on their skills and their roles within the company. Umble *et al.* (2003) also categorised the right selection of project team and project board members as success factors for ERP implementation and this factor is repeatedly mentioned by other researchers in literature (e.g.: Wang *et al*., 2008). Based on the questionnaire and interview findings the project team and project board in IBC had a significant role in the success of the BEHKO project (according to all IBC respondents). The project team identified the IBC process gaps and the required changes in each process area.

Process

- ***Process and Sub-Process Structure***

In 2002, IBC experienced significant growth and needed to expand its production line. IBC needed to design and produce luxury coaches with DAF drive chassis and cooperated with

DAF Bus (VDL Bus) of the Netherlands as its exclusive agency (Company profile, documentary evidence). However, according to the questionnaire findings (section 4) most of the business areas were manual. Furthermore, in the interview process IBC Commercial Manager asserted that because of this, management decided to implement an information system to help them to increase company performance. Additionally, since IBC was launched, the company had no experience of any major information system packages, except the use of spreadsheets and Microsoft office packages (Head of IT, interview question). In 2003, they implemented the SHOMARAN system, which only supported the sales and finance processes. At that time, the company focused on automating the sales and finance functions. However, the automation of the IBC sales and finance processes did not bring any significant benefits, for several reasons.

Primarily, what IBC needed was automation of its production, purchase and inventory processes: implementing SHOMARAN system did not change these business processes and the new system did not really solve their problem because the link between business processes and strategy was not well established. IBC did not identify its main business process. The company strategy was better performance and increasing production, but they only changed the financial and sales processes. According to the Automate-Informate-Transformate model (1998), the finance and sales processes improved to automated phase. However, the following processes: logistics and purchase, administration and shop floor processes as shown below, did not even reach the automate phase.

Figure 39: IBC Business Processes before BEHKO

In 2006, the company signed a contract with Iran municipalities and rural management organisation to manufacture 500 city buses (documentary evidence, IBC profile). In order to meet the demand on time, IBC decided to implement an ERP or integrated system to replace its SHOMARAN system with BEHKO TOTAL System (see Figure 39, above). According to the questionnaire findings, at this point, the company wanted to improve business performance and integrate systems across all departments and position the company for growth. The company was keen to improve inventory and production planning. In order to improve operations and production line efficiencies, they needed to ensure their business processes were as effective and efficient as possible and to identify the main process areas where improvements were necessary to help the company to achieve its goals and objectives.

In line with CMM, most processes and sub-processes in IBC were at level 4; however, certain sub-processes in human resources and logistics and distribution were still between level 1 and 2. According to the Automate-Informate-Transformate model, sales and marketing, purchase and procurement, manufacturing, and financial process had been improved to the informate level, moving toward transformate. Meanwhile, human resources and logistics and distribution, in some of it sub-processes, had only reached the automate phase. The questionnaire respondents reported that the main barrier to getting all processes to the transformate stage was finance, but also that they did not feel some processes still being at automate stage was seriously affecting the company. IBC was careful to prioritise the processes (especially inventory) that would bring the company maximum benefit for their money when implementing BEKKO as an ERP.

Based on the conceptual framework, it is clear that IBC's business processes had been changed by the BEHKO TOTAL system in a number of ways. According to the questionnaire and interview findings, the company defined its business processes to fit the choices available on the ERP system it was adopting. Therefore, it used the BEHKO system as a basis for defining its six main existing processes as manufacturing, sales and marketing, finance, logistics and distribution, purchase and procurement, and human resources (see process map Figure 17, Chapter 5). The findings show that the company had been able to improve its finance, sales and marketing, purchase and procurement, and logistics & distribution processes. BEHKO brought automation to the planning and production of the manufacturing process for the first time, streamlining the process and enabling the company to meet its obligations. As a result, IBC defines its main objectives and mission as to increase production and improve quality.

- ***Process Assessment***

The SHOMARAN finance and sales modules were both basic systems and could not keep up with the IBC business needs. The researcher's reflection on interview data suggested the reporting system was very simple and was not able to extract all required data for the reports the company wanted to produce. In addition, the Head of Finance needed to access sales and purchasing reports. In terms of CMM, the adopted information system in 2003 (SHOMARAN system) for finance and sales department was within the level 2 and level 3, whereas in other departments it was still within the level 1 and level 2. For example, in the following departments, IBC logistics, and purchase, administration and shop floor processes involved with using Microsoft office and a series of spreadsheets, which led to many human errors. In all cases none of the departments progressed to level 3 and level 4. If we then look at the Automate-Informate-Transformate model (1998), the finance and sales process had progressed to the informate phase, but other departments had only reached the automate phase. However, multiple departments, as shown above, did not even reach the automate phase. Using the conceptual model, we can see what some of the factors that led to unsuccessful implementation were. For example, in term of Process change, IBC not only did not prioritise its business processes, they also did not evaluate the cost/benefit implications of improvement in different process areas.

On the other hand, after adopting BEHKO TOTAL system, the IBC processes and sub-processes improved significantly. In terms of CMM, most of IBC's business processes were within level 4 and level 5 whereas other processes, as mentioned above, were within level 1 and 2. IBC defined its processes and sub-processes prior to BEHKO deployment. This helped the company to evaluate the processes and improve those business processes that would bring most benefits.

6.3.1.2 Implementation phase

Technology

- ***ERP Module Deployment***

The researcher's reflection on the questionnaire data (section 2) suggested the initial focus was in the logistics and distribution process area, to establish consistent inventory product codes and simplify and standardise product information for both internal processes and for customer facing sales and marketing departments. According to the Head of IT, this helped data conversion for other modules as they could easily define the necessary raw materials and components in other modules (e.g. purchasing, finance etc.) The deployment of other modules happened at the same time, alongside data migration. The software provider was responsible for data migration. The data migration was complex for IBC, as they had to migrate data from spreadsheets or multiple paper based systems to BEHKO modules (questionnaire, section 2, question 11).

The IBC module deployment was strategically planned. Systems modules were introduced in stages, completing in 2012. The BEHKO project team determined that the logistics and distribution would be the first to be converted to the new system and this module went ‘live’ before any others; this systematic approach helped users to understand the new system. IBC chose to implement the software on premises in response to risk of security breach and data loss. In terms of the Stages of Growth Theory Model (Nolan, 1979) the ERP deployment and data migration were at integration level because the BEHKO system deployed successfully and its structure reflected the business and the information flows across the IBC. However, not all systems were integrated; data migration had occurred but as a one-off switch of data from old systems to new. This means it is difficult to justify a claim that all departments were at an integration stage.

- ***Implementation Process***

Questionnaire (section 2, implementation phase) data indicated that IBC pursued a phased implementation to enable careful phasing out of previous systems and a managed exchange of data between old and new system. In addition, it allowed staff to adapt to the changes in systems and procedures in an orderly and controlled manner (questionnaire, Commercial Manager). The first phase, which took around three months, involved implementation of logistics and distribution. In the second phase finance, sales, marketing, purchase and production planning and planning modules were implemented. In all, it took three years to implement the system.

- ***System Ownership***

At IBC, the head of each department was responsible for the new system, monitored and led the system upgrades, changes or maintenance. According to the interview with the Head of IT, IBC aimed to help the users to feel comfortable with the system and feel comfortable sharing their knowledge with different teams and different departments. Therefore, selecting someone with enough knowledge and with higher authority facilitated the training and finally the implementation process. There is a great deal of literature that stresses the importance of the support and commitment of top management to successful ERP implementation (e.g. Holland *et al.*, 1999; Nah *et al*., 2003; Sharma & Yetton, 2003; Snider *et al*., 2009) and this importance seems to be confirmed by this study's findings; at IBC senior managers were involved in the BEHKO project from the start and their leadership helped the system to be accepted and valued by the workers.

- ***Critical Technology Issues***

Many researchers such as Holland *et al.* (1999) point to the need to provide appropriate IT resources for ERP project success, and IBC recognised that regular power cuts were the main issue that could affect their ERP implementation; therefore, they overcame this issue by providing an Uninterruptable Power Supply (UPS), which increased the confidence of users in the system and prevented production downtime that might otherwise have occurred (asserted on both questionnaire and interview data).

People

- ***System Users (system administrator and system champions)***

After the project board and project team identified the company goals, objectives and scope of the project, and also identified the main business processes, they focused on job roles and the responsibilities of users. They selected key participants, system administrators, and system champions for each identified process. Koh and Loh (2004) state that an ERP team should include the best people in an organisation and according to the Head of IT (questionnaire, section 3), at IBC the selection of system champions was based on the individual's charismatic personality and skills, which was of great help to the vendor in the training process. He also later mentioned that identifying system users smoothed the project process. The system champions were trusted by IBC's workers and were able to relate the vendors' training to practical examples that workers could relate to and this increased users' satisfaction (Somers and Nelson, 2004) and decreased fear of losing their jobs. The necessity for trust in ERP implementation processes is stressed by Neeley (2006).

In terms of PCMM, IBC is at Predictable level regarding system users for several factors. Firstly, IBC established and set up its main system users and system champions for each process, which enabled them to accelerate the ERP project. Secondly, interview respondents expressed the view that system champion performance built the trust of main users and even management. This helped the main users to feel more involved in the project and trust the system champions throughout the ERP project. Furthermore, selecting the right system users and system champions spread the learning more rapidly across the company and increased productivity.

- ***Training and Staff Development***

IBC requested full training from the vendor. In the interview, the IBC Head of IT asserted that for a small company, it was an expensive programme to engage in; however, it was essential for project success. The Head of IT mentioned that the vendor found it very difficult to encourage older staff to learn the new system. He further claimed that the most difficult level of system support was how to satisfy the users and encourage them to learn and share the new knowledge. The Commercial Manager of IBC believed that the initial resistance of staff to the project had a negative impact on other users and company performance. He also believed that the resistance was due to fear of losing jobs. Therefore, as can be seen, training played an important role in the success of the project and helped to alleviate workers' fears. The Head of IT mentioned that all users felt comfortable to use the system as they were trained well and knew how to work with system.

In terms of PCMM, the level of training and staff development is in Optimising level as IBC provided full training for continual improvement. In addition, IBC selected system champions and main users to accelerate the training program. In terms of the conceptual model, providing regular training and staff development programs improved the performance of workgroups and individuals. This also helped main users to understand their weaknesses and strengths and to continue to make progress.

Zhang *et al*. (2005) argued that organisational culture affects the success of ERP systems implementation and in terms of the cultural environment in Iranian SMEs, providing staff development was perceived to increase the competence of users, who felt they could use this to impress their managers and seek for promotion. Interview respondents stressed the leadership role of senior managers in this context: if managers are open with their knowledge and share expertise, this openness spreads to other levels in the organisation and ERP systems can become integrated into daily work much faster. However, the findings suggest that if senior managers are fearful of sharing knowledge, this attitude spreads throughout the organisation.

Botta *et al.* (2005) also emphasised the effects of human behaviour and culture in ERP implementation success.

- ***Effective Project Management***

The software vendor provided a project manager for IBC to manage the BEHKO project who planned and managed the activities of the project. The interview with the Head of IT in IBC suggested that having a skilful project manager was one of the main success factors of the project. The rest of the respondents in IBC also mentioned this. He further also stated that having a project manager was very beneficial as it helped to identify project scope, plan the project time, and cost before implementing the system. These findings accord with much of the literature: for example, Umble *et al.* (2003) argued that the competence of the project manager affects ERP project success, while Amid *et al.* (2012) also listed lack of a skilful project manager as a CFF during ERP implementation.

In the context of Iranian organisation culture, recruiting a project manager from outside of the company is somewhat risky as it is difficult for the company to trust someone external. However, IBC managed this situation very well by appointing its Head of IT to work closely with the project manager. This led to better decisions making during the ERP project for various reasons: firstly, the Head of IT was familiar with IBC strategy and objectives and more importantly, he was trusted within the company. Secondly, the project manager was able see solutions based on his experience in other companies and had project management skills, while the IT manager is competent in IT and had deep knowledge of the company's processes. Therefore, the combination of these two skill sets increased the possibility of success in the ERP project.

Process

- ***Documentation***

Ungan (2006) stressed the importance of standardization in building successful |ERP systems and insisted that documentation was central to standardization, allowing organisations to achieve reputable and integrated systems throughout. Unfortunately, the IBC company had no documentation to show exactly how the ERP system works. For example, there were no documents describing the processes involved in different modules or the functions that could be performed; it is possible that the vendors retained this documentation in order to maintain a relationship with the company. In the questionnaire (section 4), the Head of IT stated that each BEHKO module has a range of functionality; however, users only used the function they have been trained on and many of the available functions were not being used by the company. Using the conceptual model, we can see that lack of documentation forced IBC to use the vendor to provide more training for users, which leads to increased training costs. Furthermore, this lack of documentation meant that IBC was unable to recognise the weaknesses in its processes. Although the interview respondents generally expressed satisfaction with the system, on closer questioning some weaknesses were apparent; for example, in the inventory process BEHKO system did not compare the price for different suppliers. If IBC had its full system documentation it is possible such weaknesses would be more apparent and solutions would have been available in other functionalities.

- ***Standardisation***

According to IBC questionnaire data (section 4, question 6), IBC did not set any standard for processes to follow, and users just followed the routine of using the system. This shows that IBC had similar workflows and business processes to the business model within the BEHKO package. Davis (2005) estimated that a standard version of an ERP package does cover approximately 20% of a business's processes and needs to be adjusted. However, it seems that IBC handled the gap very well. Having said that, findings revealed that IBC initially established a common hardware platform and associated technical standards for BEHKO across all departments, by using standard procedures and practices, which aided the company to move into a 'one team' approach its separate departments.

- ***Process Change***

Questionnaire findings indicate that the existing IS strategy at IBC was adopted in 2008 in support of the company's business strategy to expand production and drive up bottom-line company profit. The strategy was a formal decision made by project board and project team. IBC's previous systems were a mix of off-the-shelf packages and end-user applications. Implementing integrated software brought radical changes to IBC's business processes. These major renovations in processes helped the company to achieve breakthrough performance. IBC needed to change the way their processes worked to match the best practices programmed in the BEHKO TOTAL system; in other words, by implementing the functionality of the BEHKO system the company realised how their processes should be done (see Table 30, below). IBC experienced huge improvements to their business processes when implementing BEHKO system; moreover, IBC was able to keep the same basic processes with minor tweaks.

IBC Previous processes	**IBC Previous sub-processes**	**IBC current processes**	**IBC current sub-processes**
			Accounts payable
			Accounts receivable
			General ledger
	Accounts receivable		Accounting stock
	Stock control		Inventory Management
			Primary distribution and after sales services
			Agency distributors
			Sales Management
			Marketing Management
			Production planning and production
			Quality control
	Engineering		Engineering
			Personnel management
			Training
	Health and safety		Health and safety
		Purchase and procurement	Purchase Management

Table 29: IBC Process and Sub-Processes Change Progress

For example, one of the first processes IBC was concerned with was inventory. The researcher's reflection on the interview data and documentary evidence of BEHKO's system suggested this process had been inefficient for IBC for many years, including inconsistency in product designations, which negatively affected customer satisfaction. The use of incorrect product designations resulted in incorrect orders for raw material, unnecessary production, and delivery of the wrong product to customers. That meant wasted money and time for the company and duplication in all processes. In addition, IBC's goal of manufacturing high quality spare parts and buses for Iran Municipalities and Rural Management Organisation placed a priority on ordering and purchasing high quality materials. This was especially true for IBC, which had to order large batches of materials from China, (due to the sanctions on Iran). Therefore, with issues of cross-border transactions and volatile exchange rates, the need for automated processes for inventory and manufacturing was essential. In the past, due to the nature of their product, they mostly needed different thicknesses of steel, of which the main suppliers were Zobahan Isfahan or Foolad Mobarake Isfahan (Isfahan Steel Company).

Below is the description of how BEHKO helped the IBC manufacturing process works, such as what job they need to start, what is the next, what shortages are around, manpower issues, over stocking, which were all collected after the questionnaire and interviews in order to understand the process steps. In the manufacturing process in IBC only production planning and production was automated with the BEHKO TOTAL system. The example IBC provided for the researcher is one unit city bus. Below (Figure 40, documentary evidence) is an example of a city bus Bill of Materials structure in the BEHKO inventory module (it does not includes all parts):

Description:	BOM Quantity	assembly time
- City Bus		
• BOM of City Bus		
. Part Number and description		
5010-11-00084 (Air intake box)	2	
5010-20-00104 (Upper air intake box)	2	
5102-01-00010 (Mudguard rubber fix)	8	
B0200030.00100 (Connect steel plate)	12	
5010-11-00329 (Air intake duct)	2	

Figure 40: Example of City Bus Structure

It is possible to add an unlimited number of images and other attachments in order to make them available to shop floor employees in real time.

In this case, when, for example, the Iran Municipalities and Rural Management Organisation place their order, they create a work order in the module, which has a unique work order number. Works order is an instruction to the manufacturing team to make a certain quantity of a product, for a certain date, using a pre-defined set of materials/components (from BOM) by going through a pre-defined set of processes/operations. It shows the assembly time for each unit of the city bus, and time for inspection and quality control. There are certain rules that affect the MRP calculation such as minimum stock level (this is quantity that MRP strives to maintain in stock all the times), minimum batch size (MRP will always suggest at least this quantity). This work order can be seen in other modules along with drawings and any other supplementary documents that may be required. The module has the ability for users to review the availability of supply for all of the prime components on the BOM of the works order. For every component on BOM they have visibility of available stock, any quantity on order and any requirements not yet on order. In other words, this gives a complete visibility of all stock to users.

BEHKO MRP is only ever going to be interested in the delivery date that will drive the demands. MRP works backward from the delivery using four variables to determine dates (see Figure 41, documentary evidence).

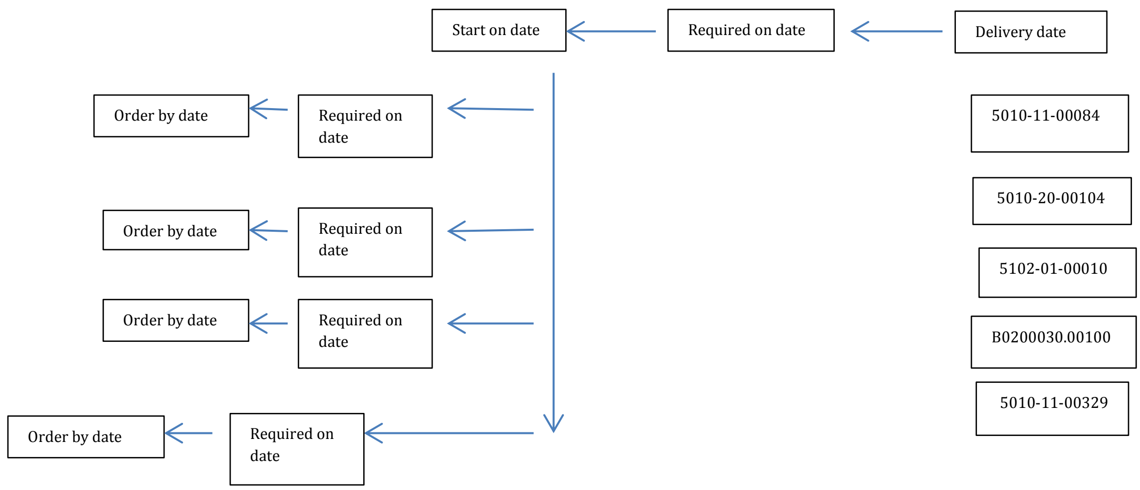


Figure 41: How BEHKO Calculate Dates

Required date of the final product uses transit dates, which represent the number of days it takes to transport the goods to the customer- so when they enter a delivery date on the sales order, it states when they intend to get the product to the customer. The "Start on" date of the final product uses routing, which determines how long it takes to assemble the product and this time is deducted from the required on date to determine the "start on" date. Then the "required on" date of components uses inspection days, which represent the days IBC needs to receive the parts from the supplier to having it ready to use. It caters for the company inspection requirements. Finally, order by date of the components is using lead time which represent the supplier lead time and subtracting this from the components "required on date" give the IBC "order by date".

The module also has the ability to set the location for delivery; however, IBC respondents mentioned that this function is not much used by the company. Table 31 below shows the changes in the processes and sub-processes of the company, illustrating which ones have become automated as a result of ERP implementation.

IBC Previous process	IBC Previous sub processes	Automated	IBC current process	IBC current sub processes	Automated
				Accounts payable	√
				Accounts receivable	√
				General ledger	√
	Accounts receivable	√		Accounting stock	√
	Stock control	×		Inventory Management	√
				Primary distribution and after sales services	×
				Agency distributors	×
				Sales Management	√
				Marketing Management	√
				Production planning and production	√
				Quality control	×
	Engineering	×		Engineering	×
				Personnel management	√
				Training	×
	Health and safety	×		Health and safety	×
			Purchase and procurement	Purchase Management	√

Table 30: IBC Process and Sub-process Automation

As mentioned above, the information system strategy adopted in IBC has been to implement modules of BEHKO total system in the core business process areas, some of which have been customised to meet the specific requirements of the company. Although the BEHKO system modules are well integrated, there is no effective integration with the stand alone SEVEN system, nor with the MS Excel and MS access applications. Some sub-processes are still manual or supported by using spreadsheets and semi-automated file exchange.

6.3.1.3 Post Implementation Phase

Technology

- ***Upgrade and Maintenance***

As a result of current financial constraints, the IBC company was not able to upgrade at the time of data collection. The Head of IT (section 2, question 18) asserted in the questionnaire that the company was now planning a major upgrade to the BEHKO ERP product in 2017 to improve functionalities, which was expected to allow the replacement of the SEVEN package and other standalone applications; however, this depended on the available budget for IT. The vendor supported the company for maintenance and training for two years after implementation. It seems the current version of BEHKO meets the business needs. IBC's intention on upgrade is to automate some sub-processes such as training, health and safety, and agency distributors. Therefore, the upgrade decision in IBC was based on their need for more functionality.

- ***Data Accuracy***

The major challenge for IBC was the accuracy of data after data migration. According to the Head of IT (questionnaire, section 2, question 19) because of transferring data from multiple paper-based systems, there was inconsistency and lack of accuracy on legacy data. However, the interview findings revealed that the vendor tried to convert the data; they had not determined which legacy data was fit for moving to new system. So they were, in a manner of speaking, dropping existing data straight to the new system. Subsequently, BEHKO modules were linked together and respondents reported that inaccurate data had had an effect on other modules. This danger of beginning a new system with inaccurate data is also emphasised by many other researchers, such as Sum *et al.* (1997) and Yusuf *et al.* (2004).

In terms of the conceptual model, IBC obviously had inaccurate data during implementation, which affects the implementation's time scope and also users' performance and effectiveness. This show a lack of planning regarding data quality. The inaccuracy of the IBC data was mainly based on entering paper based data manually. This is preventable by using more efficient users, monitoring and controlling multiple source documents and identifying inappropriate data.

People

- ***User Satisfaction***

Based on questionnaire findings (section 4, question 13) and follow up interviews, the users are satisfied with the system. However, this based on is anecdotal quotes from the respondents and IBC did not assess user satisfaction. The IBC could assess its user's satisfaction through a survey, which would be helpful to the company for future decision making, for upgrading the system and training.

The main reason upon this claim is based on the way users adapted themselves with the system and ease of use of the system. Furthermore, IBC involved its users in the project and provided appropriate training. From the Iranian organisation culture points of view, the resistance to using the system was mostly due to the fear of job loss. The resistance to using the system in IBC was mostly based on users' age (section 4, question 16) with older workers being generally more resistant; however, it seems IBC handled this issue by involving them in the project. Therefore, while the issue of integrating workers into the ERP implementation was well handled, IBC could have maintained this positive approach by collecting feedback on users' satisfaction to help design upgrades and improve training.

- ***Follow up Training in case of Upgrade***

The researcher's reflection on questionnaire data (section 4, questions 14, 15) revealed that IBC provided training at the start of each financial year on BEHKO modules, if any users needed refresher training, or the company had recruited new employees. IBC also used its current users to train new users, which saved lots of money for the company. Providing training after implementing system motivated users for further improvement in performance either individually or in a team.

Process

- ***Process ownership***

The researcher's reflection on the questionnaire data (section 4, question 8) suggested that the head of each department administrated their own processes. In terms of the conceptual model, selecting someone who understands a process before it is automated will help the company to improve the automated process. This is because they know how the process works and they can educate main users and accelerate the training process.

- ***Communication***

According to the interview findings, IBC provided an ongoing communication mechanism with its users at all stages of ERP implementation through system owners, system champions, and project team and project board. In terms of the conceptual model, communication is important at all stages as not only can the company communicate the project benefits, but also it improves the teamwork and users feel involved in the project. This builds trust in users to adapt with the changes. IBC interview findings indicated an association between communication and BEHKO implementation project success, consistent with literature such as Nah and Lau (2001) and Noudoosbeni et al. (2009).

- ***Documentation***

As previously mentioned, IBC did not have any process documentation. They found that producing such documentation would be time consuming and expensive. In terms of CMM model, the IBC documentation is at level 1, as there is no organised documentation for each process. This explains why IBC had huge investment in training. The documentation could have helped them to spend less money on training and help them to understand their processes better. Furthermore, understanding the processes would help them to identify problems that may exist in the new system. In terms of Ungan's (2006) perspective on standardisation, documentation is what turns tacit knowledge into explicit knowledge, and at IBC this seems to be as true at the organisational level as it is at the individual. Documentation would help IBC to formalise the reserves of knowledge in the organisation and share it more efficiently, reducing the time and expense needed for training.

- ***Process Improvement***

The BEHKO system covers all six processes in IBC; however, HR and Logistics are partly automated. For example, training and health and safety sub-processes in the HR process are manual, and the agency distribution sub-process in logistics is manual. In terms of the CMM model, manufacturing, purchase, sales and finance in IBC reach level 4 (processes are managed) whereas HR and logistics are between level 2 and 3 (some sub-process processes are organised). However, the respondents reported they were generally satisfied with this situation and did not feel the lack of automation in certain administrative systems was a problem for IBC. As long as the production process and the processes that supported it directly were automated, they felt this was most important to IBC success and the other functions could be included in due course.

6.3.1.4 Summary

The new BEHKO Total system can be viewed as a successful implementation as the three elements of change (people, process, and technology) improved gradually and stayed balanced. Throughout the BEHKO project the three main elements of change were kept in balance and it can be viewed as a successful implementation project. This is illustrated in figure 40 below, which is based on the conceptual model adapted to show the progress of IBC's ERP project.

In terms of the CMM model the process change in IBC was between level 3 to 4 as the company defined its process area based on company business activities. Furthermore, the company improved and managed its processes constantly. This is in line with the conceptual model in this research. The elements of process change, such as defining processes and sub-processes structure, process assessment, process change, process ownership, communication and process improvement, were covered appropriately by IBC. Some elements such as documentation and standardisation were overlooked during the process change; however, overall process change in IBC was past the satisfactory level based on the study findings.

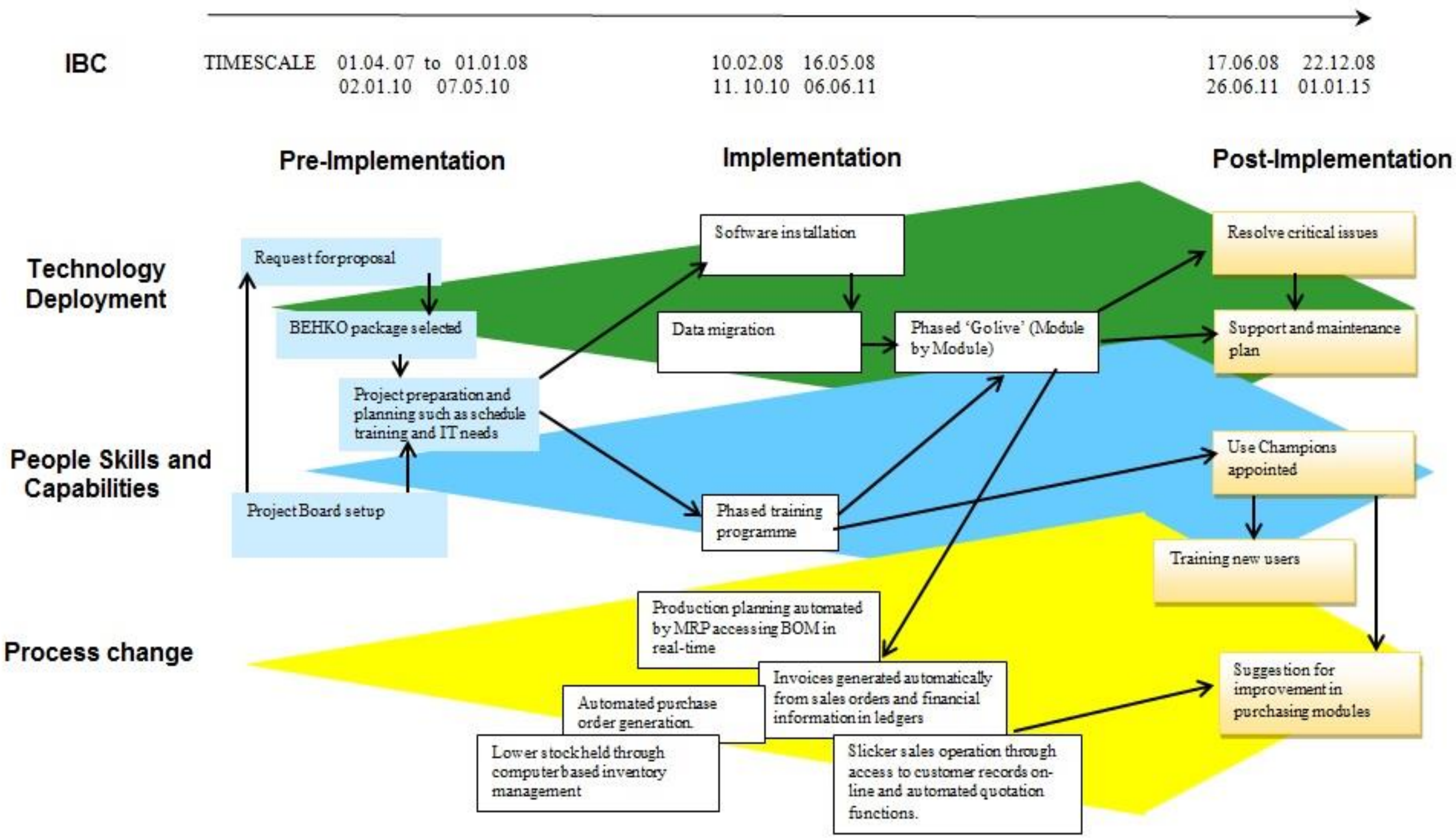


Figure 42: ERP Implementation at IBC

In terms of the PCMM model the people change reached the optimised level. Users were encouraged to improve their performance individually and in a team. All users were skilful and keen to mentor and coach new users. Users' performance was aligned with company needs. In term of Nolan's stage growth model the technology change in IBC reached the maturity stage. The elements of technology change in IBC had been covered appropriately during the BEHKO project.

Applying the conceptual model for analysis shows that three dimensions of change (people, process, and technology) affected the success of ERP implementation. IBC tried to keep the three dimensions in balance; however, there are some issues that they need to consider: for example, the documentation of the processes and using appropriate methods for data conversion.

6.3.2 ETS Analysis

6.3.2.1 Pre- Implementation Phase

Technology

- ***IT Infrastructure***

The researcher's reflection on questionnaire data (section 1, question 4) was that ETS operates in just one main building, and thus they needed only to provide a local area network (LAN) to connect their computers together. Before the implementation of the GREEN/GALAX ERP system, the company had one server and 20 desktop computers (questionnaire, section 1, questions 10, 12). Therefore, ETS needed to provide more servers and computers for the new project. According to ETS interview findings (question 3) after considering whole project cost, company replaced their existing server, added another server, and bought five other desktop computers. One of the servers was a database server and the other one a webserver in which GREEN/GALAX modules were installed. The backups were scheduled on the database server alongside offsite backup in case of any failure in the database server. Running GREEN/GALAX modules on webserver and having offsite backup added reliability to the business. This is because it is very likely that a database server would fail and it would take too much time to maintain. Therefore, running software modules on another server prevented this issue and if the database server failed, system was still able to continue to operate. ETS needed to be aware that its servers require regular maintenance, especially as they do not have an individual server for backup. Wang *et al.* (2008) state that problems with IT infrastructure is one of the CFFs of ERP implementation and the findings indicate that there was a gap in the maintenance of the database server between the vendor and ETS contracting a third-party company to maintain it. Researchers such as Al_Fawaz *et al.* (2010) and Loh and Koh (2004) have also highlighted the importance of IT maintenance to successful ERP implementation.

- ***Information Reporting***

According to questionnaire findings, prior to implementing GREEN/GALAX software, ETS had no efficient reports for its processes (section 2, question 1). Providing reports was time consuming for users, and it was not accurate all the time. Then when the company decided to adopt the new system, it requested reports for all selected modules. According to the Head of IT (Section 5 in questionnaire) the report were parts of module processes, they could easily be activated when needed. For example, finance modules could generate reports on available sales invoices and the purchase invoices matched to a period, and sales margin reports. However, processes such as inventory or HR, which involve a series of spreadsheets or paperwork, can affect the accuracy of these reports. Any human errors on those two processes lead to inaccurate data transfer between other departments that can affect their performance.

- ***Package and Module Selection***

According to ETS interview findings (question 6), the selection of GREEN/GALAX module was a formal decision by company directors, the IT advisor and software provider. The choice of modules was based on the company’s existing processes and designed to improve and execute ETS business strategy. GREEN/GALAX is an Iranian product based in Tehran province. The selection criteria were based on language, availability of the Persian calendar and cost of the software. The new system was needed to improve production and improve the data availability.

- ***<u>Data Conversion</u>***

Researcher reflection on questionnaire data (section 2, question 7) suggested that the data conversion procedure was based on software provider guidelines. Initially, the software provider requested ETS to define the company details. ETS stored all its company data in an excel worksheet called “ETS”. All the parts were stored in an excel worksheet called “BOMs”. Data conversion for processes that involved spreadsheets and Microsoft office was not difficult. However, any mistake and inaccuracy in the format provided by software provider could have delayed importing the data. According to the Head of IT, due to the manual errors such as spelling mistakes, or using invalid characters like apostrophes, there was some delayed data import during implementation. This increased the importance of having a competent implementation team during the project. Despite these minor human errors, the data conversion plan seems to have been robust, as recommended by studies such as Ngai *et al*. (2008), Loh and Koh (2004) and Zhang *et al*. (2005), who stress the need for data conversion and data accuracy plans being in place prior to implementation.

- ***<u>Customisation</u>***

GREEN/GALAX Modules were implemented without customisation (section 2, question 8). The Head of IT asserted that company directors did not want to spend more on customisation and believed that the modules were able to execute ETS’s business strategy. The findings indicate that the domestic software developed in Iran provided standard solutions to Iranian SMEs, which mostly met the surveyed companies’ business processes unless the company had a unique business process. These decreased the level of customisation required so that the time and cost could be reduced and system upgrades and maintenance were easier. Many studies identify low levels of customisation as a CSF for ERP implementation, including Al-Mashari *et al.* (2003), Al-Mudimigh (2007), and Davenport (2000) who all stress that limited customisation increases integration, reliability, functionality and interoperability.

People

- ***<u>IT and Computer Literacy</u>***

Questionnaire data (section 3, question1) suggested that unfortunately ETS employees did not reach the appropriate level of IT and computer literacy. As mentioned in the findings(section 3, question 2), they had no IT department and only one Head of IT, responsible for all of the company’s systems, in addition to one database administrator who controlled, maintained and upgraded the whole system. The lack of IT and computer literacy delayed the training of personnel who were to use the ERP modules, and increased the level of resistance to the new system within the users.

Literature frequently emphasises the effects that IT and computer literacy has on ERP project success. Users with higher IT and computer literacy have better view of overall concepts of IS/ ERP. This can even increase their understanding of how their performance can affect other business processes. The findings indicate that selecting competent users positively affects ERP success, as they are responsible for system performance, while literature such as Akkermans and Helden (2002) identifies user training as important to ERP implementation, while user knowledge was mentioned by Rashmi *et al*. (2008) and Upadhyay and Dan (2009) as CSFs for ERP in developing countries. The failure of ETS to increase the competence of its employees soon enough may have contributed to the relative lack of success of their implementation.

- ***Awareness of Goals and ERP Project***

Questionnaire data (section 3, question 5) indicated that ETS had not have a clear understanding of its objectives, as they did not link their business processes with their strategy. It seems company was confused about its goals and exactly why they wanted to implement an ERP. This resulted in the choice of incorrect software from the ERP vendor. For example, according to ETS respondents, company wanted to increase the production and improve the performance of the manufacturing process. However, in order to improve their operational processes, ETS also needed to implement an inventory module to maximise production; however, this was not selected. Wong *et al*. (2005) identify software misfit as a CFF of ERP implantation; therefore, it is very important to have clear goals and objectives for how the ERP system can integrate business processes (Akkermans and Helden, 2002), which will create a clear road map for an ERP project.

- ***Selection of Main Users and System Champions***

Questionnaire data (section 3, question 5) suggested that there was a lack of training, lack of understanding of the system and lack of employee engagement throughout the whole implementation process. There was no standard way for selecting the key users of ETS; the assumption was that any employee would adapt to the new system independently with the training provided.

Ives *et al.* (1980) emphasise the importance of selecting key users based on their personal characteristics (such as their influence on others, level of skills, etc.) for ERP project success. Selecting key users before implementing ERP and involving them in the ERP project is essential for the project success (Mandal and Gunasekaran, 2002; Yusuf *et al.*, 2004). ETS would have decreased the resistance of users by selecting key users and system champions, who could have led other users through a process of adaptation. This is because for SMEs such as ETS, operating within the existing cultural environment in Iranian SMEs, implementing a new system represented a threat for users of losing their jobs, which affected the whole project. Therefore, involving users in an ERP project increases users' acceptance.

- ***Appointment of Project Board, and Project Team Members***

The researcher's reflection on questionnaire data (section 5) suggested that the ETS project team included directors and IT admin and consultants from the software provider (vendor), and the whole team was responsible for package selection and overseeing financial resources. ETS established the project team to help in decision making throughout the project. Selecting the right team is integral to ERP project success (Al Fawaz *et al*., 2010). In terms of the conceptual model, a project team should include the project manager, IT representatives, process owners, user representatives, and the software supplier. The ETS project team did not include all these elements (for example, user representatives were not included, which improves communication) and it therefore follows that the selection of the project team in ETS did not follow correct procedures. Furthermore, this again raised the level of resistance among users in this company.

Process

- ***Process and Sub-Process Structure***

According to the questionnaire data (sections 4 and 1), in 2013 ETS decided to automate some of its core processes, and this was embodied in its business plan, especially in finance and production planning. ETS were planning to change their processes in manufacturing and finance. They expected that automating their manufacturing would have a direct effect on delivery and distribution. Additionally, since ETS launched, company had not experienced any information system and all areas of ETS was processed by Microsoft packages and a range of spreadsheets (see figure 40). The development of new and existing products led the company to set a new business plan in 2013.

According to the questionnaire and interview findings, the business processes were not changed hugely. Findings shows that there was no clear link between company business and strategies.

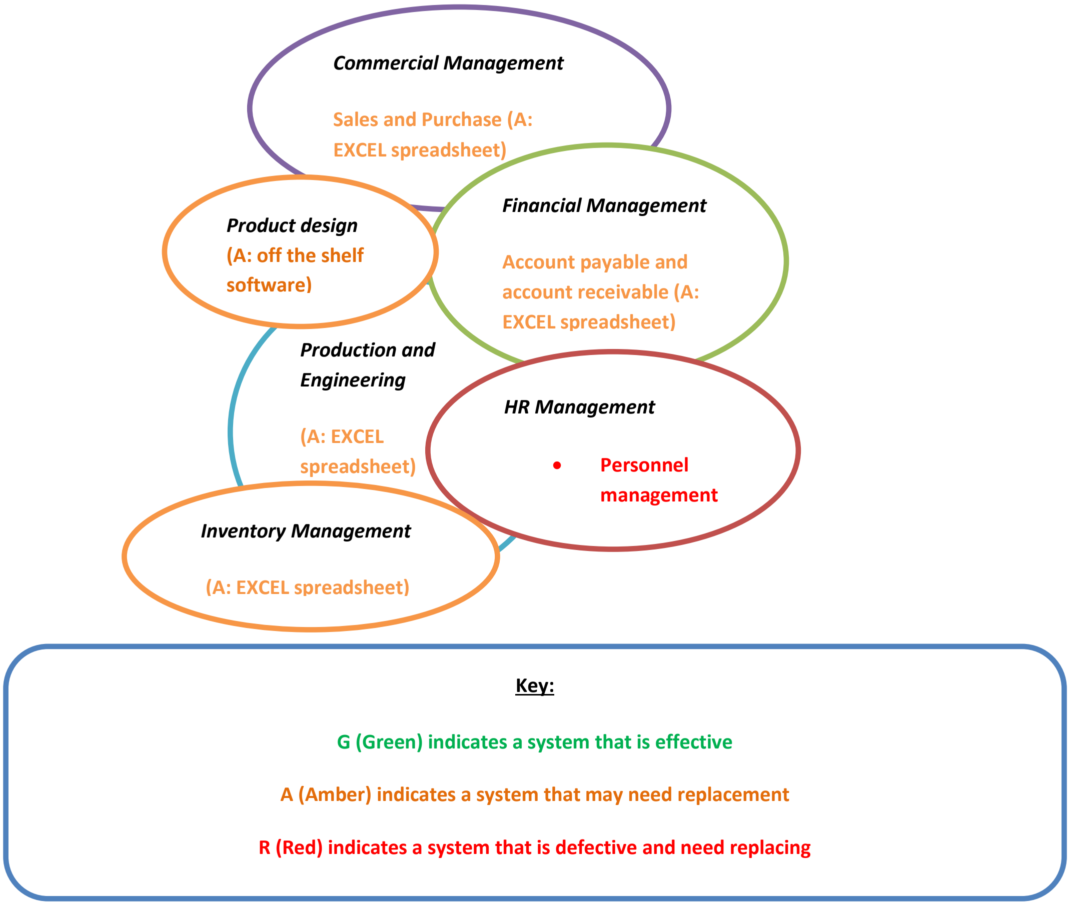


Figure 43: ETS Business Processes before the GREEN/GALAX ERP project

- ***Process Assessment***

Prior to the ERP project, the ETS process areas were supported by the Microsoft package and a range of spreadsheet and paperwork systems (questionnaire sections 1, 2). Their reporting procedures were very simple and could not deliver accurate data. As seen in figure 41, there was a dire lack of management information in all process areas. ETS needed to change the way their processes worked to match the best practices programmed in the GREEN/GALAX system. As a matter of fact, ETS needed to replace its legacy system in all processes; however, ETS was initially keen to automate its finance, manufacturing and commercial processes.

6.3.2.2 Implementation phase

Technology

- ***ERP Module Deployment***

Questionnaire findings (section 2, question 14) indicated that ETS chose to implement the software on its own premises to overcome a perceived risk of security breach and data loss. Modules of the GREEN/GALAX ERP were implemented simultaneously in core business functions in the period of October to December 2014. The ETS Head of IT during the interview mentioned that the module deployment was not planned very well for several reasons. For example, ETS did not give a clear picture of goals of the ERP project to users. This leads to uncertainly among the users of what was happening and how they needed to cope with changes. Holland *et al.* (1999) identify communication within a company to keep users of a new ERP system informed of goals and the progress towards them as a CSF for EPR. Therefore, it seems that deploying a whole ERP system at the same time is possible in SMEs, but only if the company plans for the whole adoption process; for example, by preparing it employees in order to create a positive environment among users. Furthermore, preparing and planning before real implementation gives users an opportunity to be prepared for changes.

- ***Implementation Process***

The researcher reflection on questionnaire data (section 2, questions 12 and 16, also see figure 28, chapter 5) indicated that the strategy used for the implementation in ETS was a Big bang implementation. ETS adopted its selected modules at the same time and all modules went live together. This implementation process was risky for ETS due to the lack of planning for the go live phase. The lack of planning and communication before implementation may have damaged the whole business process. This is because, in Big Bang implementation, when new system goes live, it is impossible to go back to the old system. Then if the users are not prepared to accept the changes or how to work with the new system, many things can go wrong. Moreover, all modules in ETS were integrated, so failure in one module could affects the others. Because ETS is a small company and on a single site, and all modules was from the same vendor, there were relatively few 'go live' issues. Furthermore, lack of financial resources in ETS was another reason for choosing Big Bang method to save both time and money. Having said that, even though ETS saved time and money on the implementation decision, they put the company at risk of failure due to the lack of capability among its employees for handling the level of change happening at the same time.

- ***System Ownership***

Many studies of ERP implementation have identified top management involvement and support as CSFs (e.g. Nah *et al.,* 2006; Holland *et al.,* 1999; Snider *et al*., 2009). At ETS the head of each department was made responsible for the new system, and for monitoring and leading the system upgrade, change or maintenance (section 2, question 13). Selecting system ownership in ETS can be categorised as a positive move by the company. This is because system ownership was given to senior managers who had enough knowledge and higher authority to be able to smooth the training for key users.

- ***Critical Technical Issues***

Regular power cut and poor internet connection are the major issues in ETS. These negatively affect the system update and company business performance. Moreover, when there is a power cut, ETS has to rely on its database server and offline backup, losing real time functionality. This issue is exacerbated by the maintenance issues with the database server explained above. ETS failed to introduce a 'troubleshooting' capability during its implementation, as recommended by Holland *et al.* (1999), and therefore faced periods where the ERP system was unavailable.

People

- ***System Users (system administrator and system champions)***

The researcher's reflection on questionnaire and interview data indicated that the head of each department administered their own module. The database administrator is responsible for controlling, maintaining and upgrading the whole systems. In addition, ETS's Head of IT was able to administer the whole system by the director's permission as data base administrator. Company structure and staff positions remained the same. The previous users were simply trained to use the new system. Muscatello and Chen (2008) state that it is important that an ERP implementation team should ask users about their expectations, requirements and concerns in the planning process and the conceptual model expects user representation on project teams, where at ETS the lack of user involvement in the project as a whole shows a lack of trust between the directors and users.

- ***Training and Staff Development***

Whereas the literature recommends that extensive training be undertaken before implementing an ERP (Nah *et al.,* 2001; Kumar *et al*., 2010; Noudoosbeni *et al*., 2010), limited training in ETS happened after software installation but before go live (questionnaire findings, section 3, question 5; documentary evidence, figure 28). Users only trained for the modules they had been appointed to use. Training was poor and insufficient and there have been significant users' issues with some departments reverting to previous semi-manual processes. The training for each module consisted of three days. Therefore, the training was very short and condensed. It is not feasible to provide a logical picture of all concepts of the ERP modules in three days for users. Although the ownership of the system by senior managers in ETS had a positive effect on facilitating training program, at the final point training in ETS did not reach an acceptable level. The lack of training and planning resulted in fear and uncertainly between users.

- ***Effective Project Management***

Questionnaire findings indicate the software vendor planned the project for ETS. Due to financial constraints, ETS did not appoint any internal project manager to work with the vendor. This decision is contrary to researchers in the area (e.g. Holland *et al.,* 1999; Noudoosbeni *et al*., 2010) who recommend that project management should involve, among other things, knowledge transfer management, which is easier if both vendor and client are involved equally. This decision may have contributed to the unplanned implementation and training process in ETS. ETS could have balanced this by selecting a representative and well-defined project team. As mentioned before, the cultural environment in Iranian SMEs makes it difficult for outside project manager to make strategic decisions that will be implemented in full. Therefore, establishing a well-defined project team with an internal project manager able to take strategic decisions in cooperation with the vendor could decrease the tension between vendors and their clients in Iranian SMEs.

Process

- ***Documentation***

The questionnaire data (section 4, question 5) indicated that there is no documentation to show how the system works exactly and ETS users only follow the training workshops notes if they need to know had on how to use a particular function. Lack of documentation prevents companies from recognising the weakness in process area and increases the need for training, which entails higher costs. This phenomenon of lack of documentation causing weaknesses in processes is documented in Ungan (2006) as documents provide a written and graphical representation of processes that help new user to understand them and key users to standardise and refine them.

- ***Standardisation***

According to the questionnaire findings, ETS (section 4, question 6) did not set any standards for processes to follow, and users follow the routines and standards that were set in the system. This again emphasises the advantage of domestic ERP packages developed in Iran, which have processes appropriate to Iranian companies' workflows and business processes besides their other advantages in terms of language, calendar and accessibility of support. Ungan (2006) asserts the value of ERP systems that are as close to the existing processes of a company as possible, observing that this retains the system's integrity and saves costs on training.

- ***Process Change***

The current information system strategy was adopted at ETS in 2014 and is based on GREEN/GALAX ERP package, combined with point solutions developed in MS Excel. Implementing integrated software has brought radical changes to ETS's business processes (see Table 31, below). However, based on a synthesis of both questionnaire and interview data, it does not seem that these major renovations in processes helped the company to achieve breakthrough performance. ETS needed to change the way their processes work to match the best practices programmed in the GREEN/GALAX system, however, ETS made a priority of automating their finance and manufacturing and commercial departments. If ETS had prioritised the automation of its inventory, manufacturing and purchasing processes this might have enabled them to have a more efficient purchasing relationship with their suppliers. The main suppliers for ETS are Zobahan Isfahan or Foolad Mobarake Isfahan (Isfahan Steel Company).

In order to understand how the commercial process changed we compared ETS's previous sales order procedure with the way GREEN/GALAX helps ETS deal with its customer. For example, in order to raise a sales order, sales department used to send a copy of sales order to manufacturing. Manufacturing department sent a request of BOM to inventory to ensure they had enough components for production. If there was a need for purchase, inventory management needed to raise a purchase order and send it to company director and head of commercial for approval. After a purchase order was approved, last step was finance approval to enable purchase department to order to suppliers.

The new process helped ETS to keep the record of customers and suppliers in the system or even create a new record for new customers or suppliers, which reduced the work force commitment required for data entering. In new system, when a user in the sales department raises the sales order, manufacturing and finance are notified of the new sales order. Manufacturing module calculates BOM and a hard copy will go to inventory, inventory department will compare the demand with available stock to generate a list of requirements. A copy of requested requirements is then sent to commercial and director for approval. An approved is then raised with purchase department, which generates an invoice for finance. As soon as invoice is generated, finance will receive a flag for new invoice order. As can be seen from this description, the systems covering inventory, manufacturing and purchasing are not fully automated and include some manual functions that slow down the process flow and increase the potential for human error. This is the result of the initial decision to prioritise finance functions rather than inventory: a strategic decision that was perhaps not properly planned and led to subsequent problems, identified by Holland *et al.* (1999) as a requirement of successful ERP projects.

Following reflection on the documentary evidence about the ETS system (see figure 25, 26) the researcher is able to offer a description of how the GREEN/GALAX system helped ETS deal with its customers. The Modules have a holding place for all companies in the company file. For example, in the commercial module, user can go to add/edit company and pull up the record for exiting customer or create a new company record.

Company name is a unique identifier for the company and can be changed. Users are also able to access to customer records by ticking this option. Therefore, accessing to both customer and suppliers record can be seen as huge change for the company. This is while they can also flag a company as both supplier and customer boxes. This helps company to automatically raise orders. The module has capability of 225 characters for the company notes to briefly describe the company. ETS is able to give a status to its customer, this will determine the level of business ETS are prepared to do with that customer. There are four statuses predefined and one must be ticked; these include “OK”, “On Hold”, “On stop”, Pro-Forma”. The sales order will carry a status.

ETS Previous process	**ETS Previous sub processes**	**Automated**	**ETS current process**	**ETS current sub processes**	**Automated**
				Accounting	√
	Account receivable	×			
	Stock control	×		Stock control	×
	Distribution	×		Distribution	×
		×		Customer service	√
		×			
	Purchase	×			
	Production	×		Production & assembly	√
	Engineering	×		Quality control	√
				Personnel management	×
	Health and safety	×			
Product design	Product design	√		Product design	√

Table 31: ETS Processes and Sub-Processes: Automation assessment

As can be seen, there also remain a number of file exchange operations whereby data is extracted from GREEN/GALAX system and input into standalone applications for inventory management and product design. The HR system needs to be automated and integrated with finance and accounting department to prevent duplication and data inconsistencies in payroll.

Similarly, the inventory management module of the GREEN/GALAX system needs to be ushered in to provide consistent product codes and enhance the capability and functionalities of the company business activities.

6.3.2.3 Post-Implementation Phase

Technology

- ***Upgrade and Maintenance***

Due to financial constraints, ETS did not sign up for the regular maintenance and upgrade of the system (section 2, question 18). According to the Head of IT (section 2, question 18) in ETS, GREEN/GALAX has not designed a new version of the ERP systems modules. In 2015, external consultants were engaged to review the status of the ERP project and in particular, to provide training and user support. At time of data collection ETS used a third party for maintenance for a number of reasons, including: firstly, the third party consultancy offered a lower price for maintenance and advice than the vendor. Secondly, they were more accessible than the vendor due to the geographical location, being based in Isfahan rather than Tehran. It seems that upgrade factors for Iranian SMEs really depended on financial resources and accessibility and perceived support of the vendor.

- ***Data Accuracy***

Reflection on the questionnaire findings suggested to the researcher that the lack of satisfaction and high level of resistance to the ERP system from users caused some inaccuracy and duplications in data. The Head of IT asserted that those users that were not willing to use the system mostly caused data duplication or entered wrong data to the system (questionnaire, section 2, question 5). Furthermore, inaccuracy in the inventory increased the imprecision in other processes due the integrated nature of the system. Kumar *et al*. (2010) mention the need for data accuracy when implementing a new ERP system.

People

- ***User Satisfaction***

Based on questionnaire findings and follow up interviews, the users are not satisfied with the system. There main reason for this claim is based on the way users resisted using the system. Lack of training and competent users, lack of trust between users and managers, fear from losing job increased the level of frustration among users. While researchers such as Somers and Nelson (2004), Law and Ngai (2007) and Wu and Wang (2007) stress the need for users to be satisfied with functionality of the system and trust the information it provides, at ETS users seem to have started their relationship to the system based on fear and mistrust. This resulted in some staff reverting to manual processes or previous software, leaving data gaps in the ERP system.

- ***Follow up Training in case of Upgrade***

According to ETS respondents (section 3, question 14), there was no training program after implementation finished. The Head of IT believed the company needed to provide some further insights and training through the system for users; however, the company felt constrained by budget. The implementation of the new modules has not been adequately coordinated with change in people capability. The company needs to address the training issues to encourage and support employees is using all of the available functions in new systems. Again, providing a positive environment to increase the trust among users could have assisted the training process. The situation in ETS shows that the fear of losing a job discourages users from educating other users. This issue of unwillingness to share knowledge to protect a job position is not evidenced in the literature to the researcher's best knowledge, and may be particular to the environment of Iranian SMEs or to some broader cultural factor in Iran or developing countries.

Process

- ***Process Ownership***

Process owner at ETS are Head of departments (section 4, question 8). This is a positive move by ETS. Due to the level of understanding that process owners have of their process, they can build trust between users and top management, by supporting and training users, and this provides the level of top-management engagement and support recommended by researchers such as Akkermans and Helden (2002) and Holland *et al*. (1999).

- ***Communication***

In contrast to the importance of communication as a CSF identified by, for example, Holland *et al.* (1999), Noudoosbeni et al. (2010) and Somers and Nelson (2004), there was a lack of communication between employees and top management regarding the ERP system at ETS (questionnaire findings, section 3, question 6). So based on the findings there is still some resistance from users to use the system based on uncertainty. However, according to the Head of IT (sections 2, 3, 4), the system technology was good, but users were still unfamiliar with the system and did not feel comfortable in using it. The researcher's reflection on this factor suggests that process owners can improve this confidence gap, by supporting users and providing a friendly and trusting environment, which should help to increase the teamwork, and involve the users in daily decision-making.

- ***Documentation***

Although Ungan (2006) concludes that documentation allows companies greater control and ownership over their own systems and reduces the need for expensive external training, ETS has no documentation on its ERP processes, deciding at an early stage that producing such documents would be an expensive and time consuming procedure for the company. This lack of on organised documentation has diminished the performance and increased the need for outside training.

- ***Process Improvement***

As a result of current financial constraint, the ETS Company is not able to implement new modules at the moment, and there is no plan for future adoption and upgrade. This is despite inventory and HR needing a replacement. In terms of CMM model the manufacturing, finance, and commercial processes are between level 3 and 4, because they are organised and managed at some levels. ETS inventory is based on spreadsheets and can lead to human errors, which can affect other processes.

6.4.2.4 Summary

Applying the conceptual model for analysis shows that the three dimensions of change (people, process, and technology) are affecting the success of ERP implementation at ETS. The company has mostly focused on technology and has given lower priority to the importance of people and process change. The findings from ETS show that the ERP was implemented was top-down, managed by the directors and with little input from, or consideration of, the needs of users. This is illustrated in Figure 42 below, which is based on the conceptual model and shows the progress of the ERP's implementation process.

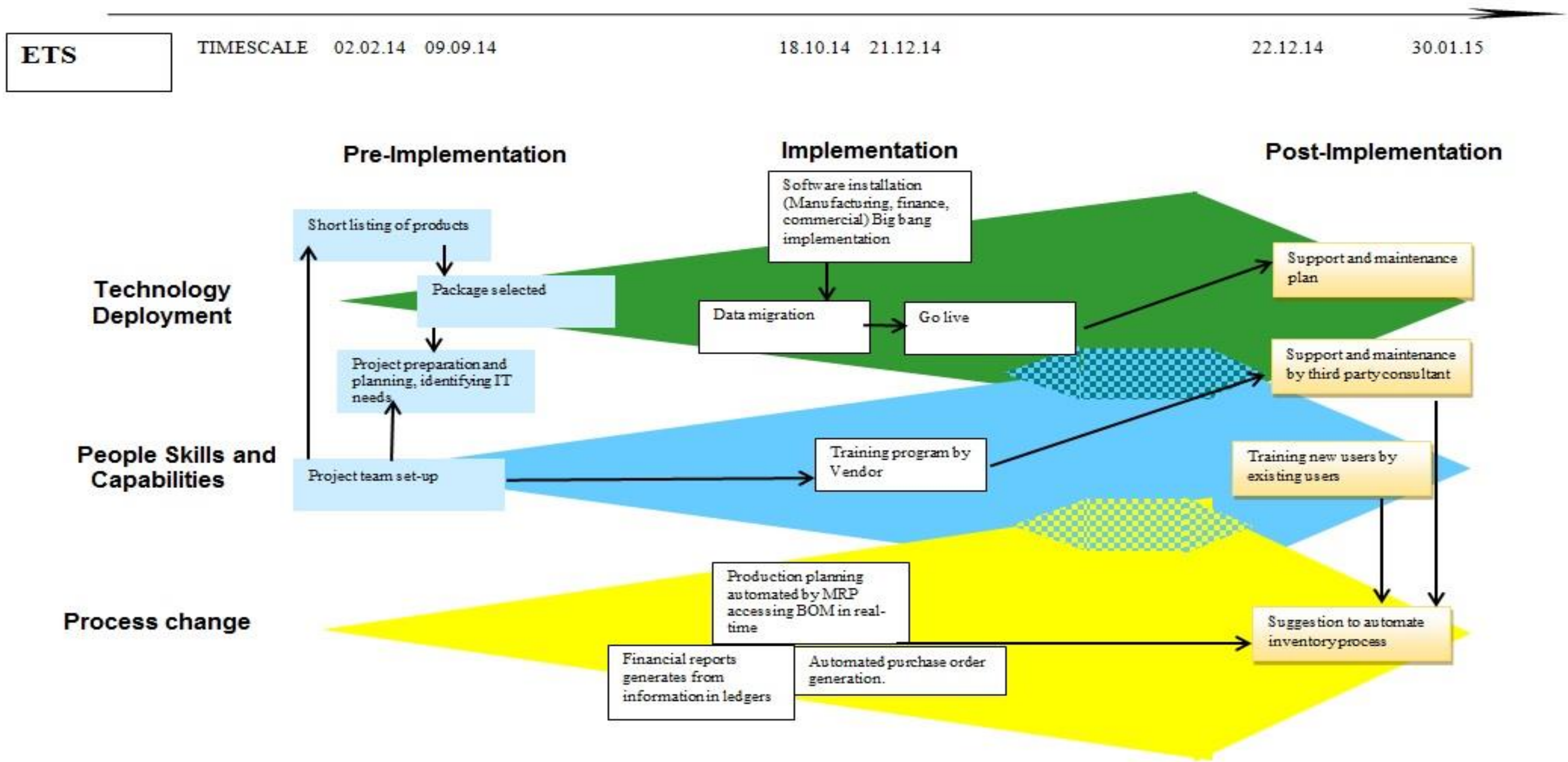


Figure 44: ERP Implementation at ETS

In terms of CMM model the process change in ETS is between level 3 to 4, as the company defined its process area based on company business activities. Furthermore, ETS has improved and managed its processes constantly. In line with the conceptual model, in this research the elements of process change have not been supported appropriately by ETS. In terms of PCMM model the people change dimension is between initial and managed level. This is because ETS has failed in recruiting competent users and providing appropriate training for users. Applying conceptual model for analysis shows that three dimensions of change (people, process, and technology) have affected the success of ERP implementation. ETS have not kept the three dimensions in balance and there are many issues that they need to consider for future improvement.

6.3.3 SPC Analysis

6.3.3.1 Pre-Implementation Phase

Technology

- ***IT Infrastructure***

Given that SPC operates on only one site, there was only the need to link the various departments within the organisation, and no need for inter site connectivity. SPC has one main building and needed to provide a local area network to connect all computers and network devices in the building. In addition, the researcher's reflection from interview data suggests that SPC understood that it could not afford to neglect the need for IT infrastructure to achieve project success and that they needed to provide more servers and computers for new projects. As a result, these costs were added to the implementation cost. However, they subsequently found providing several servers added reliability to business. This accords with the findings of many researchers, such as Al-Mashari and Al-Mudimigh (2003), Yusuf *et al.* (2004), and Zhang *et al.* (2005), who have also emphasised the importance of providing appropriate IT infrastructure in ERP projects success.

- ***Information Reporting***

According to questionnaire data (section 5) prior to the HAMKARAN system, SPC had no control over its information reporting. Providing reports was time consuming for users, and it was not accurate all the time. Implementing HAMKARAN modules give them a capability to generate reports for all modules in real time. For example, this helped SPC to access consistent reports on sales and finance; however, only directors and heads of department had the privilege of generating reports (according to the interview data). Having the right report with the right format facilitates decision making, especially among the managers, and sharing the decisions made provides a good communication within the company, As many researchers acknowledge (e.g. Nah *et al.,* 2001; Noudoosbeni *et al*., 2010; Dixit and Prakas, 2011), good communication leads toward ERP project success.

- ***Package and Module Selection***

Selection of the HAMKARAN modules was a formal decision by the project team. The modules selected were based on company processes to improve and execute SPC business strategy. The new system was needed to reduce the amount of duplicated processing and eliminate the inconsistency in all process area. A significant improvement in the quality and availability of data was required and has been achieved by the new system (interview data).

As explained in chapter 5, the package selection made by SPC was a strategic decision reached through reviewing and analysing a shortlist of products to understand the strength and weaknesses in each product and find the most suitable solutions that match with SPC's business needs. According to Janson and Subramanian (1996), any incompatibility between business needs and ERP package capabilities can lead to lengthy delays while modifications are made. Interview findings indicate the selected package was the best fit to SPC's requirements and supported its business strategy to expand production and drive up bottom-line company profit. A project team should have a comprehensive understanding of business processes to be able to choose the right package. As mentioned in chapter 5, the package selection in SPC was based on the Parsi language and calendar, and the accessibility of the vendor for further support and maintenance (SPC and vendor located in same city). Many researchers such as Skok and Legge (2002), Koh and Loh (2004) stress the importance of choosing an appropriate and skilful vendor, while researchers such as Zhang et al. (2005) and Law and Nagi (2007) identify vendor experience in terms of knowledge, feedback and service as success factors for ERP implementation; SPC respondents confirmed their vendor had these attributes and so selecting the right package and the right vendor increased the level of success and facilitated subsequent training.

- ***Data Conversion***

According to the questionnaire data (section 2, question 7) conversion was guided by the software provider. It was a planned process. According to findings, SPC firstly identified the required data and converted them into to the format software provider requested them. The project team was responsible for data conversion to reduce inaccuracy. It is useful to identify and validate the data before importing data to the new system, because efficient and validated data facilitates data migration and the whole implementation process. Akkermans and Helden (2002) acknowledge that precise data preparation and data conversion when importing in a new system is one of the CSFs for successful ERP project.

- ***Customisation***

The SPC project team believed (section 2, question 8) that there was no need for customisation and that the HAMKARAN modules were able to execute and support the business processes. The researcher's reflection on all of the findings suggests that the domestic software designed and developed in Iran provided standard solutions to Iranian SMEs, which mostly met the case study business' processes unless the company had a unique business process (like IBC). According to SPC's respondents, the absence of customisation helped software provider to provide better training and support. This also suggests that project team understood the system very well and the package selection decision was a thoughtful procedure. Avoiding customisation can speed up the ERP project and increases integration, reliability, and functionality (Al-Mashari *et al*., 2003; Al-Mudimigh, 2007; Davenport, 2000).

People

- ***IT and Computer Literacy***

Analysis of data collected from questionnaire (section 3, question 1) suggested that to manage a successful project and benefit from the HAMKARAN system, SPC needed to develop the level of skills of their main users. Therefore, SPC decided to dedicate employees with higher level of IT and computer literacy in the IT department to the HAMKARAN project. SPC also advertised for one IT manager, and one database administrator. Their experience helped the implementation process for the company and also eased the training process.

Literature frequently emphasises the effects that IT and computer literacy have in ERP project success; for example, Umble *et al*. (2003) and Davenport (1999) categorise user knowledge and skilful employees as CSFs in ERP projects in developing countries.

- ***Awareness of Goals and ERP Project***

The project team was responsible for exhibiting the goals and objectives of the HAMKARAN project to all users. At the interview stage, the Head of IT asserted the understanding of the business needs and also design of the project plan, which documented its scope, and the timeline created by project team, helped them to distribute the goals of the ERP project to the users. Understandings of goals can also enable project teams to verify business needs and workflow for the new system. The researcher's reflection on all of the findings indicates that clear goals and objectives positively affect the ERP success, as they give the user a clear understanding of project and helps them feel more involved in the project and accepting of change. Heeks (2002) and Akkerman and Helden (2002) identify awareness of goals and objectives as CSFs in developing countries for ERPs integrating business processes, which creates a clear road map for ERP projects. Researchers such as Wong *et al*. (2005) also acknowledge that clear goals and objectives lead to selection of appropriate packages that best fit the business processes.

- ***Selection of Main users and System Champions***

The SPC project team selected its existing users as they had enough skill and they were familiar with the company processes (section 3, question 3). This involved users in HAMARAN project and helped the project to go forward smoothly. Selecting the right users can help a project team for future planning in ERP project, such as planning implementation and training. Arabi *et al.* (2011) and Ives *et al*. (1980), on the basis of ERP implementation in SMEs, categorise selecting key users and system champions as CSFs. SPC decreased the resistance of users by selecting key users and system champions and involving them the in ERP project from the beginning.

- ***Appointment of Project Board, and Project Team Members***

SPC established the project team before implementation to help the project. Project team members included company director, IT manager, heads of each department, and a mixture of consultants from the vendor during package selection (interview data). After selecting a package, the project team membership was upgraded to comprise director, IT manager and heads of each department, key users and the implementation team from vendor. During the interview stage, the Head of IT asserted that having a project team helped us to identify modules which support operational needs. As can be seen, the correct choice of project team from the start of the project smooths decision-making and increases the project's success. Many researchers such as Umble *et al.* (2003), Wong *et al*. (2008), and Al Fawas *et al.* (2010) emphasise the importance of having the right project team members for ERP project success.

Process

- ***Process and Sub-Process Structure***

In 2009, SPC encountered a hugely more competitive market and needed to improve its product quality and increase its production line. SPC signed a new contract with Tehran Coach Station terminal to provide bus and minibus body parts. At the same time, they needed to keep the cost down to attract customers. Because of this, the management decided to implement an information system to help them increase company performance (Company profile, documentary evidence). Additionally, at the time SPC had no experience of any information system and all processes were a series of spreadsheets and Microsoft office packages (Figure 45, below). Then, in 2009 they implemented the HAMKARAN system, supporting all five of SPC's processes. Implementing the HAMKARAN system changed their business processes and was a good fit for the company due to the well-established link between business processes and strategies.

Figure 45: SPC Business Processes before the HAMAKARAN ERP project

- ***Process Assessment***

Previous processes in SPC used a series of spreadsheets, and MS office. They did not have consistent and accurate reports (questionnaire findings, section 1, question 12). As can be seen (see Figure, 45), there was a dire lack of management information in all processes area. SPC needed to change the way their processes worked to keep up with business needs. They needed to replace the legacy system in all processes to improve business performance. Assessing processes in company to understand the weaknesses and strength in processes can help project team to select the right package, which fits the business processes. This also reduces the needs for customisation and project time scales.

6.3.3.2 Implementation phase

Technology

- ***ERP Module Deployment***

All HAMKARAN modules were deployed at the same time. Before system went live the data migration was completed (questionnaire data, section 2, question 9). Similar to the other two case studies, SPC chose to implement the software on premises to overcome a perceived risk of security breach and data loss. Project team was responsible for module selection and deployment, again emphasising the importance of having a competent project team (interview data). Moreover, a well-planned deployment can facilitate training, and prepare users for changes. Employee representation on project team by key users also facilitates effective communication and keeps them informed of goals and progress of the project, give the key users opportunity and time to accept the changes (Holland *et al.*, 1999).

- ***Implementation Process***

According to the questionnaire data, SPC elected to pursue a phased implementation to allow employees to adapt gradually to changes in their system and ways of working. Moreover, the interview data indicates all modules were installed simultaneously in 2011 on a few desktop computers and the database server, and some key users were trained in the use of system. Systems modules were then installed on other desktops and users trained accordingly. Only then were some users put live, but this was done in a phased way and followed the order of the training programmes. The financial system users were first to use the new system, followed by manufacturing process users, sales and marketing, procurement and logistics and finally human resources users. Overall, this roll-out and move to 'go live' took four months in the period November 2011 to February 2012.

Phased 'go live' minimised the resistance of users as it prepared users for changes, giving them more time to understand the system and also helped the training process. Because all modules were implemented at the same vendor needed more consultants to be involved in implementation, which resulted in more costs for SPC. Furthermore, introducing system to process owner before to main users, helped the project team to address issues in the system and ensured a smooth transition to the new system.

- ***System ownership***

At SPC the head of each department is responsible for the new system; however, the Head of IT monitored and led any system upgrade, change or maintenance (section 2, question 13). The findings suggest that selecting someone with enough knowledge and higher authority facilitates training, decision making in the whole project, as a system owner has enough knowledge of a system and processes. There is a great deal of literature that stresses the importance of the support and commitment of top management affecting the ERP project success (Nah *et al.,* 2006; Sharma & Yetton, 2003).

- ***Critical Technology Issues***

Regular power cuts were the main issue in SPC; however, they overcame this issue by providing an Uninterruptable Power Supply (UPS) (interview data). Designing an appropriate IT architecture can reduce the influence of potential technical issues such as power cuts. Holland *et al*. (1999) categorise appropriate IT infrastructure as CSFs in ERP projects.

People

- ***System Users (system administrator and system champions)***

After the project team selected the package, they focused on the jobs and responsibilities of users. As mentioned before (section 3, question 3), SPC used its competent users as key participants. Heads of each department were responsible for their department module. Head of IT and data administrator administrated the whole system. As discussed previously, selecting key users builds the trust between users and management. Neeley's study (2006) emphasises that trust among users affects ERP project success. Furthermore, users feel more involved in whole phase of the project, which results in easier training and better performance. Koh and Loh's study (2004) emphasises selecting competent key users to facilitate training programmes and SPC also did this.

- ***Training and Staff Development***

The vendor provides a range of training for its customers. Reviewing questionnaire data (section 3, question 5) suggested that SPC requested full training to encourage users. However, individual users were trained only on the modules they needed to use. Training started with system owners (heads of department) and then training was scheduled for key users. After implementation, the vendor offered a limited period of on-site support for training. Since then, key users have been responsible to training the new users. The planned training in SPC prepared users for changes and also encouraged users for ongoing improvement. The vendor support can be seen as a success factor, as it can help project team to address issues and support users. A planned training programme also helped SPC to cope with users' resistance. Culturally, most Iranian users resist accepting changes due to fear of losing their job and insecurity of their position within the company. Meanwhile, many researchers such as Noudoosbeni *et al*. (2010) and Kumar *et al.* (2010) acknowledge training as a CSF in ERP projects, and researchers such as Zhang *et al.* (2005) and Botta *et al.* (2005) emphasise the importance of organisational culture in ERP project success. As discussed earlier (see section on IBC), providing training and staff development in

Iranian SMEs was perceived to increase the competence of users who feel they can use this to impress their managers and seek for promotion, and respondents confirmed this at SPC.

- ***Effective Project Management***

The IT manager and vendor's project manager worked together to plan the HAMKARAN project in SPC. SPC respondents (section 3, question 10) asserted that selecting someone from inside the company helped to speed up the project, as the IT manager chosen already knew all the business process. Having two project managers and a project team helped the SPC to plan its project activities efficiently. This also shows that Iranian company would rather have some from inside that outside of the company as a project manager due to the organisation culture. This compares with the findings in IBC case study that having two project managers with different views can broaden the perspective of the project and increase the project success. Furthermore, Umble *et al*. (2003) and Amid *et al*. (2012) acknowledge that skilful project managers affect ERP project success.

Process

- ***Documentation***

According to the questionnaire data (section4, question 5) the vendor did not provide any documentation to show exactly how the system works. However, in the training workshop a manual of each module, with some examples, were handed to users. SPC respondents believed there was no need for documentation as it was time consuming and expensive. Documentation can help companies to understand the process weaknesses, improve the processes, and also help them to avoid training cost for new users, but the case studies suggest this is the last thing that companies consider. This is more beneficial for vendors as it increases the needs for chargeable training. Ungan (2006) emphasises that documentation is central to standardisation, which allows companies to achieve integrated systems.

- ***Standardisation***

According to SPC questionnaire respondents (section 4, question 6), SPC did not set any standards for users to follow, and users just followed the routine of the system. It seems HAMKARAN system had similar processes to SPC workflows and business processes. This also indicates that the SPC project team selected the right package that fitted the business processes. The study findings emphasise the advantages of selecting a domestic product developed in Iran, as discussed in previous cases. Moreover, Ungan (2006) states that organisations must be consistent in their operations if they are to survive and grow and the study findings suggest that it was the implementation of an ERP system that brought a measure of standardisation and consistency to the case study companies that did not exist before ERP implementation.

- ***Process Change***

Implementing the HAMKARAN system brought radical changes to SPC's business processes (see Table 32, below). According to questionnaire and interview findings, SPC defined its six main processes as manufacturing, sales & marketing, finance, logistics and distribution, and human resources. The findings show that the company improved its finance, sales and marketing, purchase and procurement, and logistics and distribution processes (Table 33, below). The manufacturing process was a new process for the company to help in production planning and production. For example, the company had no marketing, distribution or quality control sub-process. HAMKARAN was intended to increase their marketing due to the rapid growth of competition in the market. Furthermore, SPC signed contracts with many repair shops in Tehran, so they needed to distribute orders to these garages. In the previous process engineers used to check the quality of products, and it was not always obvious who had approved the quality. SPC needed to improve its quality for better customer service and sales, therefore the new system was needed to check the quality of products before they went to customers. The project team identified SPC's business needs and documented its scope to put the company in a good position for success implementation.

SPC Previous process	SPC Previous sub processes	SPC current process	SPC current sub processes
			Accounts payable
			Accounts receivable
	Accounts receivable		
	Stock control		Inventory Management
			Purchase
			Distribution
			Sales Management
			Marketing Management
	Production		Production planning and production
			Quality control
			Maintenance & engineering
			Employee administration
			Employee attendance
			Payroll

Table 32: SPC Process and Sub-Processes Change Progress

Below is a description that how HAMKARAN helped the SPC finance process work, such as how they raised sales invoiced, how they payed suppliers, and standard costs and actual costs.

In order to raise an invoice through the HAMKARAN system, SPC needs a dispatch note to invoice against. After SPC raises a sale order, they have ability to create a location, and then dispatch the product. Once the invoice has been raised, there may be a need to change the name of the customer or address; e.g.: customer needs the invoice to be addressed to specific person, so the company has the ability to edit these and can even amend the commercial notes. SPC is not able to change any amounts in invoice. If the company needs to pay a supplier, SPC needs to match the purchase invoice. The process of matching supplier invoices to both purchase orders and for subtracting receipts are practically identical to the way sales invoices are raised. After the purchase order is raised, the system can do the invoice match. They are also able to provide a credit note if they have to return goods to suppliers, which will reduce SPC's debt to suppliers in the purchase ledger.

In the HAMKARAN system standard cost represents a target cost that SPC should be able to buy purchased items for, or to make manufactured parts for. Based on standard cost, they can compare their actual costs. SPC mostly work on the standard cost for manufactured parts. Establishing actual manufactured costs involves a procedure to cost works orders upon completion. This can only be done when all the lower level costs are established.

SPC Previous process	I SPC Previous sub processes	Automated	SPC current process	SPC current sub processes	Automated
				Accounts payable	√
					√
					√
	Accounts receivable	×		General ledger	√
	Stock control	×		Inventory Management	√
				Purchase	√
				Distribution	√
				Sales Management	√
				Marketing Management	√
	Production	×		Production planning and production	√
				Quality control	√
				Maintenance & engineering	×
				Employee administration	√
				Employee attendance	√
				Payroll	√
				Training	×

Table 33: SPC Processes and Sub Processes Automation

As can be seen from the above description, HAMKARAN system modules are integrated, but link with EXCEL spreadsheet in the maintenance and engineering process is still done by file exchange. Nevertheless, the new ERP is now bedding in reasonably well, with efficiency benefits of automating former manual process now being delivered.

6.3.3.3 Post Implementation Phase

Technology

- ***Upgrade and Maintenance***

SPC had not upgraded the HAMKARAN system since 2012. The Head of IT asserted (section 2, question 20) that the company has no plan to upgrade the system due to current financial constraints and the limited budget for IT. It seems that the current version of the system supports the business processes reasonably well, and upgrading the system would depend on additional financial resources for SPC. Ghobakhlo *et al.* (2012) identify lack of financial resources in Iranian SMEs as a barrier to successful ERP implementation projects.

- ***Data Accuracy***

At SPC, the HAMKARAN modules are tightly integrated, so any inaccuracy in data entry will affect other modules. The high level of training and the existing levels of IT and computer literacy improved data accuracy. According to findings, any inaccurate data in new system is because the users entered the wrong information onto the system (section 2, question 22). However, because the system shows who entered the data, the users try to be as careful as possible, which reduces inaccuracy. Many researchers such as Kumar *et al.* (2010) and Yusuf *et al.* (2004), mentioned the need for data accuracy as CSFs in ERP projects, to begin the system with good quality data that can be built on as its user begin using it.

People

- ***User Satisfaction***

Based on questionnaire findings (section 3, question 13), the SPC users were all satisfied with the system. Their main reason for this was the way users adapted themselves to the system, and also ease of use of the system. Assessing users' satisfaction is helping the company to make future decision making an upgrade of the system and also training. Involving users in ERP projects reduces user's resistance and increases the level of satisfaction among users. User's satisfaction can be assessed through a feedback from users and monitoring their performance. Many studies such as Law and Ngai (2007) and Wu and Wang (2007) stress the importance of user satisfaction in the long term success of any ERP system.

- ***<u>Follow up Training in case of Upgrade</u>***

According to the questionnaire data (section 3, question 15) SPC have not requested any further training after implementation. Key users or system owners are responsible for training new users. This reflects the planned and comprehensive training that was provided in SPC during the implementation phase. In addition, the findings indicate that by using key users to train new users, the key users found their own skills refreshed and this led to improvements in SPC's procedures when key users returned to their regular duties. In other words, by keeping training in-house (facilitated by the module documentation) SPC seems to have been able to make small refinements to processes that have meant an expensive upgrade has not yet been necessary.

Process

- ***<u>Process ownership</u>***

The process owners in SPC are the heads of each department, who also administrate their own process (questionnaire, section 4, question 8). Process owners can facilitate training by educating system users as they have sufficient knowledge of the process. They also can identify weaknesses in the system for further improvement, emphasising the need for top-management support in any ERP project stressed by, among others, Akkermans and Helden (2002).

- ***<u>Communication</u>***

Questionnaire findings show a satisfactory level of communication in the whole of the implementation of the HAMKARAN system (section 4, question 9). From the start of the project the project team in SPC involved users in the project. This built trust and increased the teamwork among users. The importance of good lines of communication as a CSF factor identified by many researchers such as Holland *et al.* (1999), Noudoosbeni *et al*. (2010) and Somers and Nelson (2004), and the inclusion of key users represented on the project team greatly facilitated communication at SPC. The case study findings also highlight the importance of this factor throughout all phases in ERP project, not just after implementation.

- ***Documentation***

Contrary to the importance of documentation as a CSF identified by Ungan (2006) there has been a lack of documentation in SPC. All questionnaire respondents in SPC asserted that the company did not request any documentation from the software provider (section 4). In addition, SPC did not document its own processes; however, unlike the other two case studies at SPC users were able to keep their training guidelines. Documentation can help a company to improve its processes (Ungan, 2006), which may explain why the company has not yet requested any upgrade for their system. Case study findings suggest that documentation allows SMEs to have a greater control over their process by providing them the opportunity to identify weaknesses particular to that SME.

- ***Process Improvement***

The researcher's reflection from questionnaire and interview data suggested that all processes are automated in SPC, except for the training and staff development sub-process, which is still manual. As can be seen, the processes have been improved in SPC and are well-integrated. In terms of the CMM model, all processes are well organised and managed in SPC. This is because although processes are managed, it does not seem the company is looking for further improvement due to the lack of any perception of a need for upgrade.

6.3.3.4 Summary

Applying the conceptual model for analysis shows that three dimensions of change (people, process, and technology) affect the success of an ERP implementation. SPC tried to keep the three dimensions in balance; however, there are some issues that they need to consider in case of upgrade such as: the advantages of keeping customisation to a minimum, and using appropriate methods for data migration at the initial stage. This is illustrated in figure 44 below, which shows the progress of SPC's implementation process based on the conceptual model.

In terms of the CMM model the process change in SPC is between level 3 to 4 as the company defined its process area based on company business activities. Furthermore, SPC improved and managed its processes constantly. Some elements, such as documentation and standardisation, were ignored during the process change; however, overall process change in SPC passed the satisfactory level.

In terms of PCMM model the people change at SPC reached the optimised level. Users were encouraged to improve their performance individually and in a team. All key users were skilful and keen to mentor and coach new users. Users' performance aligns with company needs. In term of Nolan's stage growth model the technology change in SPC reached the maturity stage. The elements of technology change dimension in SPC were covered appropriately during HAMKARAN project.

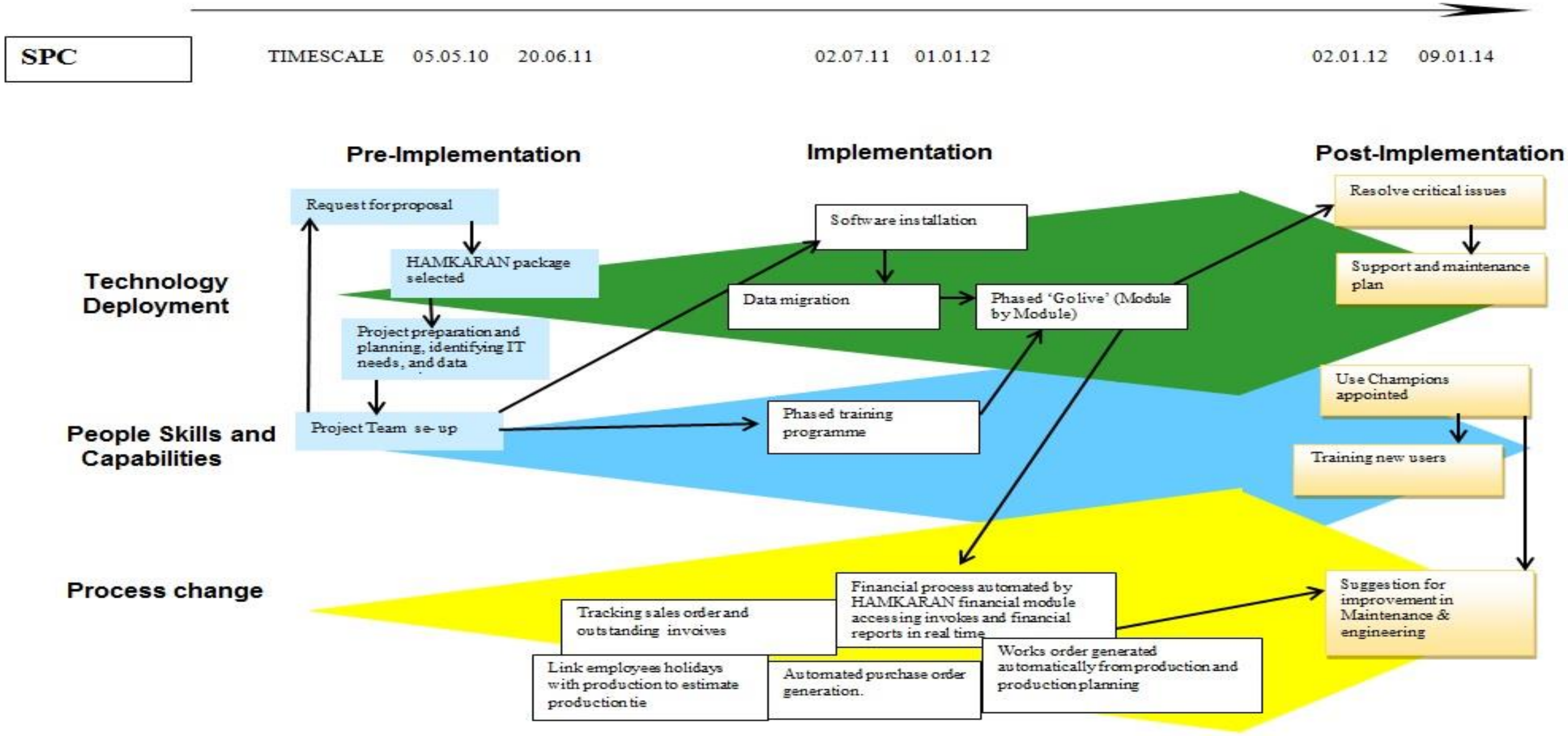


Figure 46: ERP Implementation at SPC

Chapter 7 Conclusion

7.1 Introduction

This chapter directly address the research questions and then discusses the contribution to knowledge and practice. The last section highlights limitations of this study and future research.

7.2 RQ1: What is the extent of ERP systems implementation in Iranian SMEs?

Existing studies (Amid *et al.*, 2012; Nikookar *et al.*,2010) suggest that home-grown ERP products have a significant foothold in the Iranian ERP market. This is borne out by the survey findings that indicate a high degree of adoption of domestic ERP systems among the SMEs surveyed in this study. However, usage of western software is not unknown in Iran; for example, the Isfahan Steel Company uses the Oracle E-business suite (Amid *et al.*, 2012).

According to the initial survey and follow-up telephone interviews (see figure 13, chapter 4) conducted for this study, the level of Iranian SMEs actually using integrated ERP systems at the time of data collection is broadly similar to rates of usage in the UK/developed countries (Wynn, 2008). However, a majority of Iranian SMEs use or intend to use an ERP system in the future, and either intend to use domestic solutions or are satisfied with the available domestic packages they already have (see Table 12, chapter 5). This reflects the improvement and increasing number of the ERP solutions available on the Iranian market. This also shows that Iranian products have gained a larger portion of the market share in comparison with worldwide vendors such as Oracle or SAP. The most-cited reasons for selecting domestic solutions over worldwide vendors were implementation cost, software language, and vendor support. The case studies provide some interesting insights into the market for ERPs in Iran. At present, sanctions are being eased and there are more opportunities for western-based ERP vendors. However, the domestic ERP packages have an established user base that is likely to grow, at least in the short term, due to the benefits noted above, but particularly easier customisation (lessening the total cost of implementation) and being in the Parsi language and offering Persian calendar functionality.

This study's initial survey findings indicate that the competitive market, and also the geographical location of Iran in the Middle East, encouraged Iranian SMEs to plan for implementing integrated solutions (see Table 34, below). Improving business performance, positioning the organisation for growth, integrating business processes, improving customer service, competing in the global market, and replacing old legacy systems were common reasons for using IS/ ERP in Iranian SMEs. Domestic ERP applications are used by more than half of all Iranian manufacturing SMEs (Ghobakhloo *et al.*, 2011). This can be a result of the development of domestic manufacturing packages and also the fact that domestic vendors focus on manufacturing functionalities. The study's survey findings indicate Iranian developers of ERP products have recognised the demand from manufacturing SMEs (which represent the majority of SMEs that can afford an ERP system) and have responded by concentrating on functionalities such as production and production planning, sales and marketing, inventory, logistics and procurement and finance. The research findings from the questionnaire survey revealed that there is extensive use of domestic IS/ERP packages among Iranian SMEs.

Vendor	***Solutions***	***Main Customers***	***Source (Websites)***
BEHKO	• Financial and Accounting solutions, • Sales and Marketing solutions • Supply Chain management solutions • Manufacturing solutions • HR solutions	• Asia Khodro • Rasoul Mashine • Sepahan Khodro • Airspace manufacturer	http://www.behko.com/?page_id=96
GREEN/ GALAX	• Financial and Accounting solutions • Project solutions • Retail solutions • Manufacturing solutions • HR solutions	• Tehran Council • Tehran Taxi Centre • Tehran Blood Centre • Sabz Gostar Asia • FanAva	http://www.greendataware.com/about/history/
PARS ROYAL	• Map solutions • Management Solutions • Finance Solutions • Mobile Solutions • Restaurant Solutions	• Persian Gulf Solution • Naan Solution • Saman Oil • Fooman Shimi • Ashena Clouche	http://parsroyal.net/products
MEDAR GOSTARESH	• Banking Solutions • Security Solutions • Educational Solutions • Publishing Solutions	• Tejarat Bank • Iran National Musium • Tehran university • Hamshahry News Paper	http://www.itorbit.net/
HAMKARAN SYSTEM	• Finance solutions • Manufacturing solutions • Marketing solutions • Sales solutions • HR solutions	• Gas organisation • Kachiran company • Samsung • Tehran Cement • Pasargad Oil	http://www.systemgroup.net/products/%D8%B1%D8%A7%D9%87%DA%A9%D8%A7%D8%B1-

			%D8%AF%D9%88%D9%84%D8 %AA
EADEGOSTAR	• Publishing solutions • Renting solutions	• Publishing solutions • Renting solutions • Delvary BooK • Travel Agency	http://ideagostarco.net/Page/About • Delvary BooK • Travel Agency
RAYVARZ	• Finance solutions • Stock and share management • Marketing solutions • Sales solutions	N/A	https://rayvarz.com/about-us
FARAGOSTAR	• Financial solutions • Commercial solutions • Engineering solutions • Office Automations • BPMS software	• Insurance organisation • MazMaz Crisp • Medicine Factory • Ariya pharmacy • Iran international engineering factory	http://www.faragostar.net/automation/
PARNIAN PARDAZESH PARS	• Office Automations • CRM	• Pars Automation • Parand Arvin	http://www.parnianportal.com/OA/Pages/Home.aspx
BARID SAMANEYE NOVIN	• Office Automations • Financial solutions • HR	• Pars Hotel • Bank Sina • Mobin Net	http://www.baridsoft.ir/products/integrated-approach/office-automation

Table 34: ERP Vendors, Solutions and their Main Customers

7.3 RQ2: What has been the nature of ERP implementation in Iranian SMEs? Have the change dimensions of technology deployment, process improvement and people skills enhancement been in balance? What have been the critical change elements or factors?

To ensure that the findings of the three cases studies reflect the nature of ERP implementation in Iran, the collection of the research findings was conducted in several phases including literature review, survey, questionnaire, and semi structure interviews. Through the case studies, the researcher investigated three dimension of change (technology, people, process) and a range of relevant change elements to assess the level of implementation success in manufacturing SMEs in Iran. This research question is answered by addressing the three dimensions of change in turn.

Technology

The average cost of ERP implementation among the three cases is around £45,000. Costs of ERP implementation in Iran fluctuate due to economic conditions, scope of the project and unstable consultant fees, which also affect the ERP duration. All three cases chose a single vendor for all modules, which helped them to overcome operational complexity and integration cost. The findings suggest that due to the size and small margins of Iranian SMEs, they prefer pre-configured software based on best practice. Furthermore, this reveals that software providers in Iran have developed solutions that fit manufacturing needs, and they are based on best practice of Iranian manufacturing. The Microsoft SQL Server 2008 database, C++ and Java languages are the most common platform technologies that are used by software providers. These are mainstream technologies and thus these ERP products are reasonably future-proofed

The current information system strategies at all three companies have some similarities. They all elected to adopt an ERP package from Iranian based software suppliers, to provide the benefits of integrated systems and consistent management information to support company growth aspirations. In all three companies, however, some of the old legacy systems remain in some core process areas, and these are likely to be replaced in near future with appropriate ERP systems modules.

There were significant differences between the three companies' strategy implementation approaches. At IBC, the strategy development and its implementation was agreed to, and guided by, a cross-departmental project board and project team that carefully managed a phased implementation of the BEHKO ERP product. At ETS, the GREEN/GALAX ERP package was selected as result of discussion between the IT administrator and the company director, and lacked across company involvement and support. Implementation was simultaneously in most process areas, increasing the risk of systems problems and data issues. At SPC, a phased implementation of the HAMKARAN ERP was successfully undertaken, the project spanning 2011-12. Among the cases, ETS had the shortest implementation time due to the choice of implementation strategy (Big Bang), whereas in IBC and SPC the implementation times were 3 and 2 years respectively. The implementation process in IBC exceeded their planned duration, due to financial constraints. The case study companies identified common delays to

ERP implementation, which were unplanned data conversion, data migration, and regular power cuts.

The findings of the three case studies show that all three cases have reached a point of *stasis* in their ERP implementation projects, as they do not have realistic plans for system upgrades or for expanding system functionalities throughout the business. Although all three cases use their systems actively, their business requirements are also expanding continuously. Among the various reasons for not upgrading the systems, financial constraint was the main reason. Due to the integrated nature of ERP, there is a need for reliable LAN or WAN connectivity. In all three case studies researched, they provided LAN connections; however, in IBC, due to there being two buildings, there was also a need for WAN connectivity. It is notable that in all three case studies the software is hosted within the company, so the internet connection does not really affect the system. This is not unexpected in Iran, as most of the vendors in Iran provide this deployment option. There is a general lack of knowledge about cloud products among the buyers, and more importantly poor internet connection. However, in all three cases, respondents put forward the view that they selected on-premises software to avoid data loss and the risk of security breach.

Among the cases, ETS noted that they did not know yet whether the GREEN/GALAX project had been totally successful, whereas other two cases believed their implementation was a successful project. The lack of a clear evaluation of the project at ETS derives from several facts such as not allocating enough time for initial module and package selection, poor project planning, and lack of understanding of system benefits.

The case studies of the implementation of three home grown ERP products in Iranian SMEs revealed some interesting results. The products are structured in a similar manner to their western counterparts, albeit they appear to allow greater flexibility in customisation to specific users' needs. Among the cases, IBC was the only one in need of the customisation, whereas the other two cases did not customise any features of their adopted system. This again indicates the importance of mapping business processes and business requirements before software selection

Findings reveal that there has been considerable improvement in acceptance of technology change during implementation in Iranian manufacturing SMEs, but still some external technology factors impacted upon the duration and effectiveness of the implementation process. The top three technical issues were regular power cuts, and poor internet connection.

Another common internal reason for lack of IT infrastructure (ETS) was found to be financial constraint; for example, income that has been invoiced and earmarked for IT projects is not paid on time.

The availability of the necessary funding to invest in the supporting IT infrastructure affected project outcomes in some cases. For example, lack of funding for providing appropriate database and servers to manage and store data, and the architecture design that connects servers to user groups affected the outcome of the project at ETS. Among the cases, IBC and SPC provided a well-designed IT infrastructure by providing enough servers, which they managed in order to secure data and prevent data loss. For example, IBC provided private VLAN to increase security and privacy. Designing the correct IT architecture can reduce the influence of potential technical issues such as power cuts. All cases mentioned power cuts as a technical issue, but only IBC and SPC provided Uninterruptable Power Supply (UPS) to overcome this issue.

The questionnaire data indicates that there was considerable willingness and determination among the manufacturing SMEs to implement their IS/ERP projects, and also work with, and rely upon, domestic vendors. Domestic vendors have been successful in the Iranian market by providing better service and practical software solutions. Consequently, Iranian SMEs rely on software vendor advice such as module and package selection or other technological features of ERP implementation during their implementation process. Among the cases, only ETS stopped working with its vendor due to location and accessibility. Only recently has the engagement of third party support helped to bed in the new systems modules.

The findings suggest there are several elements of the technology change dimension that vendors and Iranian SMEs should consider to maximise project success. These include requirements specification, appropriate package and module selection, a planned data conversion, the planning of logical module deployment, a phased implementation and go live, and system upgrade and support practices. Data maintenance and accuracy are also important. An established, reputable software vendor that offers good consulting support regarding training and the elements mentioned above, will also help enhance project outcomes.

People

There are some elements of change that affect IS/ ERP implementation throughout the project duration - employee skills (IT and computer literacy), awareness of goals and objectives, appropriate selection of project team and project board, identification of main users (including system champion) and their responsibilities and roles, planning and training, and having an effective project manager. Findings indicate that the people change dimension has a very significant impact on the other dimensions of change (process and technology). This is because they are involved in the decision-making processes during the project. Employees' teamwork and their collaboration to effect change make a huge difference to IS/ ERP success in SMEs in Iran. In order to illustrate the importance of people change, the elements of people change that most affected the three cases studies are discussed.

The findings suggest that those cases that appointed a competent project team and have supportive top management had a better decisions making orientation throughout the project, and made the ERP projects more successful. Project team and project board decisions in IBC and SPC regarding package and module selection, customisation (at IBC), implementation strategy, and the organisation of the training programme impacted the project positively. While the findings of this research emphasise the importance of a competent project team and project board, the influence of competent project manager(s) is equally important. In IBC and SPC, the vendors' project managers worked closely with the companies' IT managers (both working together as co-project managers) which positively affected project outcomes. A combination of internal managers who know the business and external managers who are expert in IS/ERP can positively influence technology decisions regarding IT infrastructure, implementation strategy, and package selection. Findings suggest that top management support at discrete manufacturing SMEs in Iran is essential for successful ERP adoption and deployment.

The data indicated that the first step for discrete manufacturing SMEs in Iran to achieve IS/ ERP success is to develop, understand and communicate the business objectives and goals of the project. Awareness of goals and objectives of the project and the willingness to broadcast them to users to involve them in all stages of ERP project influenced the implementation process at IBC and SPC. By involving users throughout the project, they were motivated to work as a team. Involving users and sharing the goals and objectives developed a shared perspective with management and fully engaged them in the ERP project. By contrast, in ETS, the gap between top managers and the main users affected the whole project. In ETS, the management style was in many ways typical of an Iranian private organisation culture, and put the project into risk; this issue is also referenced in literature (Dezar & Ainin, 2010; Amid *et al*., 2012). Most of the SMEs in Iran are private family businesses, managed by the owners, who make most of decisions regarding the projects. This can act against the likelihood of overall project success in which all employees buy-in to the chosen solution and the implementation process.

The poor implementation process at ETS increased resistance and fear amongst users of losing their job. Nevertheless, in all three cases in this study, there is no evidence of redundancy of employees. Indeed, they reported they even recruited more users. IBC and SPC, by involving users, increased the willingness for change among the users. In both IBC and SPC, that involvement of users and their awareness of project goals impacted positively on teamwork. Users worked together and transferred their skills to other members of the team to help in their training. The importance of teamwork and its impact on IS/ ERP project outcomes is also recognised by Markus and Tanis (2000).

Another issue that underpinned successful ERP outcomes in IBC and SPC was the selection of competent users. The selected key users in these two companies had sufficient knowledge and skills in IT and computer literacy, in contrast to ETS. This helped deliver effective training in both companies. The selection strategy at IBC was based on skills and employees' characters; whereas in SPC it was based solely on skills. Furthermore, in all cases, heads of department were selected as system users, system owners and process owners. The presence of system owners encouraged the use of the system across the organisation.

Providing the necessary training and support for end-users, guided by the project team and project board, was another success factor in SPC and IBC. By contrast, the absence of adequate training and support for end-users in ETS left the project in a parlous state. Only recently had the engagement of third party support helped to provide much-needed training. However, there is still a need for more training to ensure the system is used effectively and fully accepted by the users themselves. ETS initiated training before implementation, but the other two companies conducted planned training during the implementation phase. Training started with system users (top managers) and then moved to key users. The findings of research emphasise the importance of training. Sufficient and phased training in SPC and IBC improved users' satisfaction and minimised users' resistance.

The findings of the three cases confirm that the success of ERP/IS projects is not only based on delivering new technology, but that there are other key dimensions and change elements that influence the project. The findings of the research suggest that in the people dimension there are several influencing elements that should be considered by SMEs and vendors. These include competent main users, establishing a project team and a competent project manager, awareness of goals and objectives, and a carefully planned and implemented training programme.

Process

The research findings also suggest that the success of ERP/IS implementation in Iranian SMEs is not only influenced by technology and people change dimensions, but it is also related to associated process change. A review of the research findings identifies several elements of process change that affected project outcomes. The case studies suggest that a key first step for ERP project implementation is to understand the change management aspects and business objectives and goals of the project. Manufacturing SMEs in Iran need to be prepared for the process change challenges that are inevitable during a successful ERP project. For example, the findings have highlighted the importance of identifying and analysing business processes before software selection. The findings of this research indicate that implementing ERP may also require change in core processes. Holland *et al.* (1999) also emphasised that business processes need to be align with the selected ERP system. Therefore, businesses should be prepared to modify their processes to fit the ERP system. The misalignment of current business processes and the business model underpinning the ERP system increases the need for customisation, which negatively affects other factors such as budget cost overruns and exceeding the project timeline. Therefore, it is important for SMEs in Iran to define their business processes clearly before selecting their package.

Identifying core business processes and how the processes work, and documenting the processes, helps the organisation to understand the weaknesses in processes and improve them. Unfortunately, among the three cases studies, none of them had documentation of their processes. The findings emphasise the importance of communication throughout various stages of implementation. Communicating and sharing goals and objectives, and process changes encourage them to accept these changes and reduces resistance. Because implementing an ERP system will often change the way a process works, this results in changing the way people work. Therefore, communicating the scope of the project and how the system will impact the work of users will encourage them to cooperate with the project team.

The findings reinforce Heeks' (2002) studies and other recent studies (Akeel & Wynn, 2015) that suggest large scale technology implementation, even in SMEs, must be accompanied by appropriate process improvement and an upgrade in people skills to accommodate the new ways of working that are often introduced with new systems modules. The findings suggest that the three dimension of change are interlocked. In summary, the findings suggest that there are various elements of these three dimensions of change that have a cumulative influence on successful ERP projects in Iranian discrete manufacturing SMEs. Furthermore, a comparison of findings among the three cases suggests that the widely variable costs of ERP implementation, consequent financial constraints and international sanctions might also affect the success of ERP systems in Iranian SMEs. Small companies have limited access to financial information and lack the resources to cope with price fluctuation. As a result, prices quoted often go up during a process of implementation, resulting in incomplete or fractured ERP systems.

The analysis shows that deploying new ERP systems presents Iranian discrete manufacturing SMEs with great challenges. It seems that SPC and IBC successfully overcame these challenges. The BEHKO TOTAL system and HAMKARAN system were implemented with limited disruption. The implementation process was a little different in the three cases: IBC carefully managed implementation, which was done department by department, in parallel with a phased training programme for managers and users. At IBC and SPC, where a cross-departmental project board and project team guided and controlled the project, there was limited disruption to the companies' ERP implementation; but at ETS, the lack of a similar project management capability and a properly constituted project team represented a major risk to successful project outcomes, which is only now being adequately addressed. In particular, the BEHKO and HAMKARAN manufacturing modules, which in both IBC and SPC, which were accompanied by significant process change, were deployed and configured on time. However, ETS was a more technology focused implementation. The GREEN/ GALAX modules were implemented on time, but they did not seem to fit the company business processes very well. This resulted in part from a lack of training and company-wide awareness of the project.

However, while the BEHKO project had a good effect on business performance, the customisation in IBC led to some teething problems, particularly when upgrading the product, notably follow up training, and on-going maintenance. The findings at SPC show that the HAMKARAN modules improved the performance and improved the transparency between different departments. For example, in SPC when the company received a new order, the production department was immediately aware of their responsibility, but the inventory department could also plan what parts would be needed and the purchase department could plan access to necessary raw materials etc. The findings suggest that a focus on process improvement in the key areas where new systems were particularly required is likely to be beneficial. Therefore, implementing an entire new ERP suite without appropriate process improvement or people skills development is unlikely to prove successful; and continuous review and upgrade in all three areas will be required post implementation. Table 35, below, summarises the change element status in the three case studies undertaken in this research.

Implementation Phases	***Dimensions***	***Elements of change***	***IBC***	***ETS***	***SPC***
		IT infrastructure	4	2	4
		Information reporting	4	4	4
		Package and module selection	4	2	4
		Data conversion	2	4	4
		Customisation	3	4	4
		IT and computer Literacy	4	1	3
		Awareness of goals and ERP project	4	1	4
		Selection of main users, and system champion	3	1	3
		Appointment of project board, and project team	3	1	3
		Process and sub-process structure	4	1	4

		Process assessment	2	1	4
		ERP Modules deployment	4	2	4
		Implementation process	4	1	4
		System ownership	4	1	4
		Critical technology issues	4	2	4
		System users (system administrator, system champions	4	1	4
		Training and staff development	4	1	4
		Effective project management	4	1	4
		Documentation	1	1	1
		Standardisation	1	1	1
		Process change	4	2	4
		Upgrade and maintenance	1	1	1
		Data accuracy	4	2	4
		User satisfaction	4	2	4
		Follow up training in case of upgrade	4	1	4
		Process ownership	4	1	4
		Communication	4	1	4
		Documentation	1	1	1
		Process improvement	4	2	4

Table 35: Summary of Change Elements Derived from Data Analysis

Scale: From lowest to highest: Poor (1); Fair (2); Satisfactory (3); Good (4)

Table 35 above provides a qualitative assessment, in the judgement of the researcher, of the effectiveness with which each change element was implemented in each dimension at each phase of implementation for all of the three case studies. All the elements of change are described in chapter 3 and the judgement was based on both the questionnaire and interview data and using criteria explained in chapters 5 and 6. In order to provide a visual summary of this qualitative analysis, figure 47 (below) has been developed. It is based on a calculation made of the average qualitative score for the change elements in each dimension, mapped for each company (the coloured lines) and showing average scores for each dimension over the phases of implementation (see appendix 3). The phases progress clockwise around the model in chronological order, making the fluctuations in quality of implementation easier to follow.

Interestingly, on viewing the model it is apparent that SPC achieved the highest consistent level of quality of implementation, although from the Implementation – Technology phase onwards it had an average set of scores identical to that of IBC. ETS achieved a high score at the Pre-Implementation – Technology phase but low average scores for the other two dimensions at Pre-Implementation. Subsequently, average scores were low for all dimensions at each of the subsequent phases, suggesting that the imbalance between dimensions apparent at the Pre-Implementation phase was reflected in all the company's efforts thereafter, a phenomenon discussed in more detail in the analysis of dimensions contained in this chapter below. The most striking result for the other two companies is that while IBC and SPC both scored highly in the dimension of technology at the Implementation phase, this score fell away to only Fair at the Post-Implementation phase. The set of change elements employed in this phase are therefore important and may reveal weaknesses in the relationship between vendor and company that could lead to useful recommendations on how issues of maintenance, upgrades, documentation and training should be handled Post-Implementation.

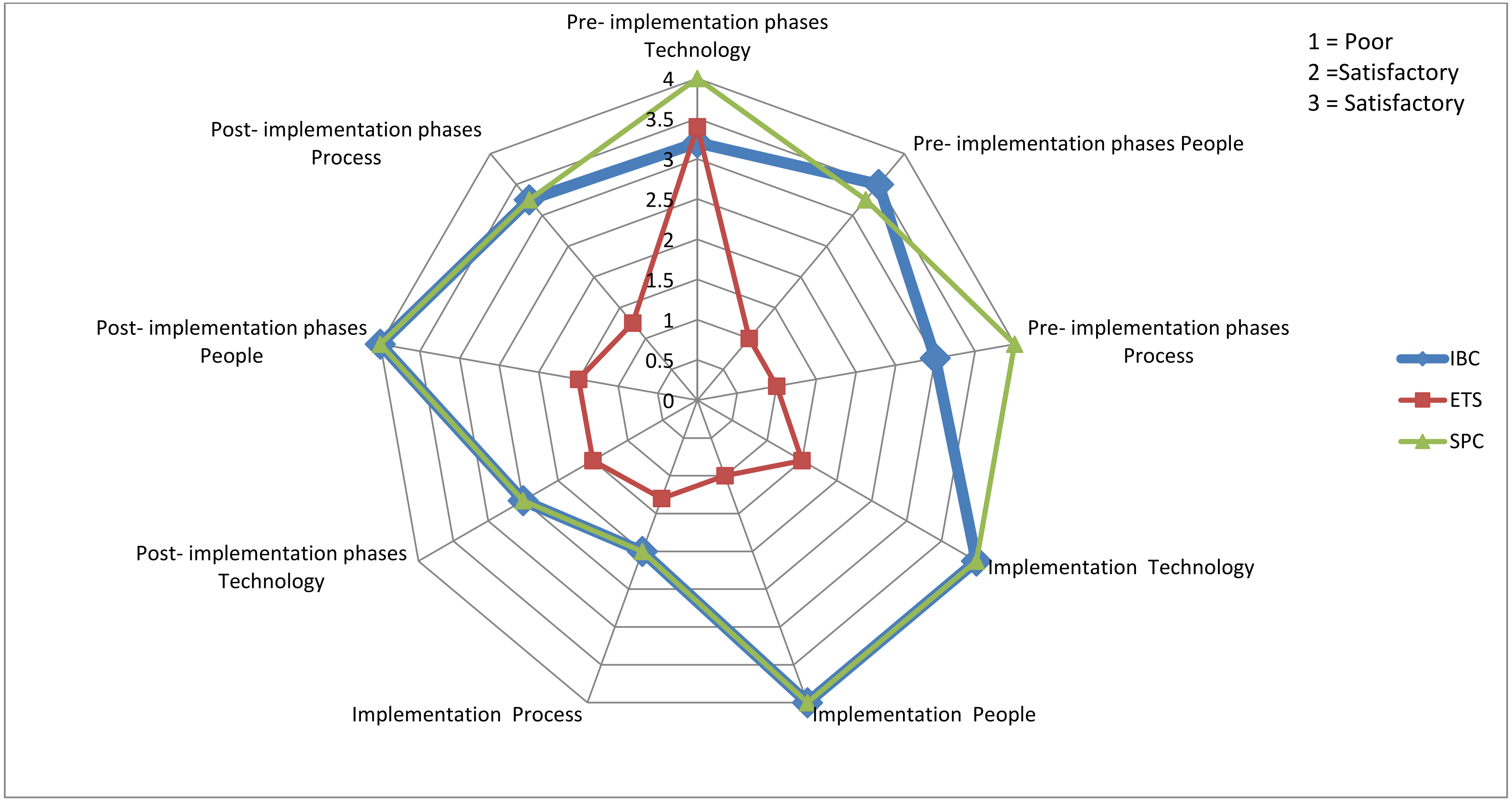


Figure 47: Dimension Averages over the Implementation Phases for each Case Study

7.4 RQ3: What new framework can be developed for Iranian SMEs to adopt and implement ERP systems to improve their business performance?

The findings of the various data collection phases of this study, analysed separately and then synthesised for points of comparison in this chapter, indicate that a framework for the adoption of ERP systems in Iranian SMEs is possible. The ERP implementation framework in this research is divided into three phases, which are: Pre-implementation phase, Implementation phase, and Post-implementation phase (see Figure 46, below). These three phases are linked to the elements of change in each main dimension (technology, people, and process). Clearly, Pre-implementation is the starting point of the ERP implementation model. The Implementation phase refers to actual implementation and Go live; and finally Post-implementation refers to the support, maintenance and system upgrade. The critical success factors of each dimension are discussed below.

Technology

Based on research findings the critical success factors in technology refer to package and module selection, data conversion and data migration, phased implementation and go live, and the need for a planned upgrade and maintenance programme.

- ***Package and Module Selection***

Based on research findings and existing literature, a careful package selection process is one of the critical success factors in an ERP project. Package selection is repeatedly mentioned in the literature as a critical success factors (e.g. Akkermans and Helden, 2002). Markus and Tanis (2000) categorise package selection as a key deliverable in an ERP project. Vendors offer packages with different functionalities, which suits different organisations with different business models in certain parts of the world. The package and module selection process is highly influenced by how clearly the project team and project board define the business processes and objectives of an ERP project. The right decision in package selection can reduce the level of customisation required, which results in cost reduction. The case studies suggest that after selecting an appropriate vendor, a company needs to decide what modules are the best fit for their business processes.

Among the cases, IBC and SPC followed a number of guidelines for package selection. In both companies, they prepared a request for proposal, which helped them to clearly understand their goals and objectives, and what they needed from a new system. This helped them to shortlist potential vendors, which were then requested to prepare workshops demonstrating their ERP systems. This also helped the companies to understand the package functionalities and what commercial arrangements the vendor could offer them. This also assisted IBC and SPC in selecting the right modules. However, ETS's module selection was not an appropriate decision for a discrete manufacturing company; the reason for this may be found in the composition of the ETS project team, which is discussed below in the People dimension – Appointment of Project Board and Project Team Members. After implementation the ETS inventory process remained manual despite, in manufacturing industry, inventory, logistics, production and production planning being the core modules for process automation.

- ***The order and phasing of ERP module deployment***

The most appropriate modules for automation in discrete manufacturing companies are inventory, logistics, production and production planning. Among the case studies IBC started its module deployment with its inventory in order to codify its stock. By contrast, at SPC all modules were installed at the same time, but SPC's 'go live' was planned to be implemented in stages. The research findings indicted that starting deployment from the inventory assists data conversion for other modules and helps to define the necessary components in other modules, especially in production and production planning, and the purchase department. Therefore, for a manufacturing company in Iran, the study results indicate that it is advisable to implement the inventory module first, especially if the inventory system is currently manual. This helps to codify the products and components, which means subsequent modules are more accurately implemented. The next modules should focus on the manufacturing process itself because it is central to the functions of all other modules, which exist primarily to allow manufacturing to operate. Manufacturing is generally followed by purchasing (although some companies embed purchasing with inventory while in others it is a part of commercial department). Other modules can then be implemented according to each company's priorities/resources.

- ***Data Conversion and Migration***

Data conversion involves identifying the required and effective data that needs to be transferred to the new system and shared among the user departments. In all three cases preparing the required data and defining company details reduced inaccuracy and made data migration faster. The research findings from IBC suggest that company owners, top management and system users should be involved during the data conversion process to ensure data quality and confirm the data that needs to be migrated to the new system. An accurate data conversion will directly influence the accuracy and quality of shared data. In all three case studies. the software vendor provided relevant data conversion tools for the companies to gather and prepare data for their new system. The research findings indicate that a successful implementation process is strongly influenced by effective data preparation and data conversion. Based on the research findings, data preparation should follow a series of stages:

1- Identify what data is needed for the new system

2- Define the company's inputs and outputs

3- Identify data sources

- ***Phased Implementation and Go Live***

The management of the implementation process is undertaken by the project team and project board should plan strategically to align this with company goals. As discussed in the literature review (see section 2.4.2), there are many implementation strategies such as Big Bang, phased, parallel. Among the cases, only ETS selected a Big Bang approach, whereas in IBC and SPC, module implementation was phased, stage by stage. The successful outcomes at IBC and SPC suggest a phased approach is likely to be the most successful, in which people change elements (project team and project board, project leadership, training and skills upgrade) are put in place in parallel with technology implementation. This assists the training, and gives more time for users to understand systems functions and associated procedures. In addition, vendors have time to support or debug the system. Furthermore, if one module fails, it does not necessarily affect the other modules.

- ***Upgrades, Maintenance and Vendor Support***

In Iran, SMEs generally have to pay for system upgrades once the initial contract with their vendor has expired (generally 1-2 years). The decision by SMEs to pay for a system upgrade is influenced by project team/project board decisions regarding system improvement based on business need. Findings suggest that if vendors had provided more maintenance support for companies implementing ERP during the period of the initial contract, this would probably have increased their willingness to upgrade. Moreover, vendors generally retained the software licences for the software they supplied as part of ERP packages. Therefore, when the software failed or lost functionality the companies were obliged to seek help from the vendors because they had no license from the software manufacturer, which led to another revenue stream for the vendors but frustration for the companies, especially if the vendors were not based nearby. The study findings also suggest that documentation is an important issue in making decisions over upgrades, maintenance and vendor support. The lack of documentation in all three cases meant that vendors were able to sell more training to the user companies; however, this also meant that the companies were unaware of the benefits that an upgrade might bring them and felt constrained by budgetary considerations. A clearer picture of how much financial benefit an upgrade or additional maintenance or vendor support might bring could be provided by properly kept documentation, which would be in the long-term interests of both vendors and their clients.

People

The people dimension encompasses the appointment of the project board, competent users, having an effective project manager and providing effective training. The research findings indicated project board and project team are the key decision makers during an ERP project.

- ***Appointment of Project Board and Project Team Members***

Findings from IBC and SPC confirm the benefits of having project board and project team members appointed to support the project, be involved in software implementation decisions, commit resources, communicate with the implementation team, and control and manage the actual implementation life cycle. The findings suggest the role of the cross- departmental project board and project team was critical in guiding the project through a number of key activities, from the request for proposals from ERP suppliers, to the selection process itself, through the phased implementation, the conduct of the training programmes and the agreement of a support and maintenance plan.

The project team and project board should clearly define business goals and objectives and business processes. The expertise, skills and experience of the project board and project team influence the decision making process through the project; for example, by defining processes and providing understanding of business needs. Project team and project board also identify main users and system champions, mostly based on their skills but in one case (IBC) also on personality. Therefore, the selection of members of project board and project team should be conducted carefully and should be built up with input from each department, as well as company directors and top managements. Among the cases only ETS had no project board, and most of the key decisions were made by company directors. The appointment of project team members in this company was not strategic and as a result, the lack of skill and competence prevented the correct decisions being made during the project, such as over training. Appropriate changes in all dimensions relates directly to the decisions that are taken by companies that are implementing new systems in cooperation with vendor project management team members and supports. This depends on how the vendor project management team and the company project team and board interact to support the project and to combine and synthesise their levels of skills and knowledge.

- ***Selection of Main Users and System Champions***

The case study research indicated that competent users in IBC and SPC facilitated training programmes and supported the implementation process. Furthermore, competent system champions in each department encouraged key users to use the system. Besides, their interaction with key users and project board and project team members increased the level of involvement and communication in IBC and SPC. In ETS there was evidence of a lack of communication and involvement among the users. The findings suggest that the selection of key users and system champions builds a communication bridge between various project teams and key users, which streamlines communication and increases the key users' involvement in ERP project decisions, to the benefit of the ERP project as a whole. Another important point from the cases is that at IBC and SPC good internal communication helped in the selection of key users, enhanced the definition of responsibilities, and made for more effective training programmes, which transferred expertise efficiently around the company. However, at ETS the failure to put together a representative project team, appoint system champions and the decision to implement in a 'big-bang' manner led to lower levels of communication, and a less effective sharing of expertise.

- ***Effective Project Manager***

Competent project management requires an experienced and skillful team to manage and plan the project. In IBC and SPC, the vendor's project manager cooperated with the project board and project team to plan and navigate the project. An experienced project manager can lay out a clear road map from the project toward a successful outcome. In SPC and IBC the project manager scheduled the project activities based on the project scope defined by the project board and project team. The cooperation among these teams helped both companies to allocate budgets and time scales to each phase, define roles and responsibilities and communicate with key users, and helped them with many other decisions such as IT infrastructure plans. In contrast, in ETS the lack of an effective project manager to guide the project team led to many ineffective decisions in the ERP project; for example, they chose a Big Bang approach to implementation and implemented the system without a clear road map, and without sufficient training. In ETS, an effective project manager would have given them a clear idea of module selection; as discussed in chapter 5 and 6, the ETS inventory process is still based on some spreadsheets and paper based systems, which affect the accuracy of data in other ERP modules. The case study findings emphasise the importance of cooperation between the project managers from the vendor and company when planning for activities in each phase. Moreover, this planning must be aligned with the company's overall strategy and goals since an ERP system is one tool for helping to attain these goals and must therefore integrate with other company tools. The lack of planning in ETS supports this statement, as the poor management decisions and planning almost caused the project to fail.

- ***Training and Staff Development***

The importance of effective and complete training was mentioned in the literature by many scholars (such as Nah *et al*., 2001; Kumar *et al*., 2010; Noudoosbeni *et al*., 2010). The case study research also indicated that in SPC and IBC planned training programmes increased user satisfaction, prevented resistance among the users, and encouraged them to use the system. Whereas in ETS insufficient training led to many misuses of the system and user resistance. The case study findings suggest that a planned programme for training is critical for ERP project success. At ETS, poor training almost caused the project's failure. This also indicates that if key users fail to use the system efficiently, the company cannot receive benefit from the system due to the inability of the system to process workflows and generate efficient reports.

The case studies also provide interesting insights regarding the focus and phasing of training programmes. The findings strongly indicate that it is better to start training programmes in discrete manufacturing SMEs with shop floor staff. The reason for this is driven by the fact that most of the shop floor employees have less educational attainment (some of them did not even finish school) and spend less time on computers. Training can be scheduled in phases, starting with training for the project board and project team early on in the pre-implementation stage.

As regards the content of the ERP training programme, it may usefully start with an overview of general functionalities in each module and how they are connected, to familiarise the project board and team members with the general functioning and structure of the software. Then they can decide on and design the training programme in detail for the project. The findings suggest that next level is training top management in their respective functional areas and the specific system module related to their department. Then, system champions can be appointed, which makes them responsible for training end users (such as shop floor workers). This can facilitate training for key users, and top management and system champions can be involved in training sessions and provide a supportive training environment for key users. Furthermore, key users will feel more comfortable with their co-workers and encourage them to use and own the system.

Correspondingly, training top management and system champions at the start of the project can help the implementation team, as they can use their knowledge during software installation. As a final point, project board, project team, or the vendor can evaluate the training programme to ensure all users trained well enough; ideally this would be the vendor because they can take an objective view of the training. This also helps them to decide and plan further training programmes. Therefore, from combining the literature and case study findings it is possible to conclude that adequate and phased training can be delivered on budget and on time, and this is a critical success factor in the implementation of ERP projects. Moreover, high-quality training that is delivered in the implementation phase can lead on to identifying further training needs in the post-implementation phase, especially if the initial training has been well-documented, so that the company knows what its workers know, and can identify what they need to be taught in the future. However, the research findings indicate that in a company such as ETS, where training was concentrated on pre-implementation due to the 'big-bang' approach, little if any training happened subsequently, especially in the post-implementation phase. It has only been recently that ETS has approached a third-party training provider to address skill shortages among its users, because their vendor was too remote for easy access. This suggests that companies should plan their training provision around the approach they take to implementation and seek to ensure that employee concerns and skill shortages are addressed at each phase.

Process

The process dimension encompasses processes and sub-processes structures that exist in the company and to what extent they need to be changed as the new ERP system is implemented. Documentation of business processes helps the company to understand business needs and system requirements throughout the project and communicate these changes to key users.

- ***Process and sub-process structure***

The research findings indicate that there was lack of knowledge regarding business processes and organisation structure among the SMEs in Iran. It was the software vendor that mapped the processes and developed solutions. Among the cases only IBC and SPC had a little understanding of the processes and sub-processes. This helped them to select the correct modules for their ERP project. Understanding business processes and how the new process should operate resulted in selecting appropriate employees for processes and selecting the right key users for system training. Furthermore, understanding current processes not only helps them to provide an efficient request for proposal for the vendor but also restructure processes to fit the new system. The more business processes fit the software, the less need for customisation, which also increases the project's success.

Using process mapping techniques and profiling existing technology deployment before selecting an ERP package is a useful technique that can be used by SMEs in these situations. Mapping a system helps the project board and project team to define work flow in each process and sub-process and determine required changes in each area. Based on research findings, the following guidelines can help manufacturing SMEs to map their processes in the following ways:

1- Document each business process to get a clear understanding of how each process currently works

2- Identify areas they want to change and how they should be linked to each other

3- Document future processes by defining gaps and issues in each area.

Identifying process and sub-processes helps the project board and project team to clarify its needs and objectives besides system requirements. Defining business processes and documenting the process is also essential for accurate decisions regarding modules and package selection. Process dimension changes require competent and experienced control teams that have in-depth knowledge about business processes to make accurate and efficient decisions.

- ***<u>Documentation</u>***

The findings of the study allow for the following observations to be made, based on what the companies implemented effectively as well as the mistakes they made. Documentation of new processes enables companies to understand remaining process weaknesses and schedule procedural improvements, which also influences the upgrade decision. Furthermore, documenting business processes not only facilitates process mapping but also helps a company implementing ERP to prepare training programmes. Proper documentation during process mapping helps the project board and project team to prepare appropriate requests for vendor proposals and also help them to identify key users' responsibilities for the new processes. The case study findings suggest that lack of documentation among the cases prevented companies from looking for improvements and upgrades to the system. The study's findings strongly indicate the central importance of documentation to the progress of a successful ERP system. If project teams map processes from the beginning of a project, identify job roles and how they integrate, and subsequently use this picture of the company's processes to identify key users and design training programmes, there is a much better prospect that the company will remain in control of the implementation. This control then extends beyond the implementation phase itself and into post-implementation, when vendor support has lapsed and issues such as training and process improvement become the company's sole responsibility (see Figure 45, below). At this point it is crucial that the company knows who has been trained to what level in which process; without this documented information ERP systems are likely to remain in a stasis until the vendor is once again commissioned to install a new upgrade, effectively starting again with the documentation they have retained.

- ***<u>Communication</u>***

Communicating the goals and objectives and sharing information during the project involves the users in the ERP project and builds trust among users and top managers. Implementing a new system leads to new structures and operations, therefore users need to adopt these changes and understand how the new process works. The case study findings suggest that effective communication during all phases of ERP project is critical to ERP success. IBC and SPC communicated and shared information in all phases, which had a positive effect in user satisfaction and training programmes. While in ETS, lack of communication increased the resistance among the users due to the fear of losing their jobs. In the context of discrete manufacturing SMEs in Iran, it is advisable for project boards and project teams to plan their communication procedures throughout the whole project (from pre-implementation to post-implementation) to involve key users in important decisions and also get feedback from them to evaluate the weaknesses or strengths in the system.

The above critical success factors indicate that keeping the dimensions of technology, people, and process in balance is key, not allowing the company to focus in one to the exclusion of the others and ensuring that progress in each dimension is synchronous. For example, if new technology in the form of computer hardware is introduced to a workforce that has not been trained to use it, the implementation becomes imbalanced and radical change in a manufacturing SME will be difficult to manage. Therefore, an incremental, step by step approach is likely to produce better outcomes. Communication and coordination among the top managers, control teams, and main users should be considered in all phases. The findings suggest that in the context of discreet manufacturing SMEs in Iran, having a strong and skilful project board and team to make strategic decision and involving users in all phases of the project is essential. The case study findings support this, as in IBC and SPC they communicated effectively with their users; as a result, their willingness to use the system was considerably higher that ETS's users.

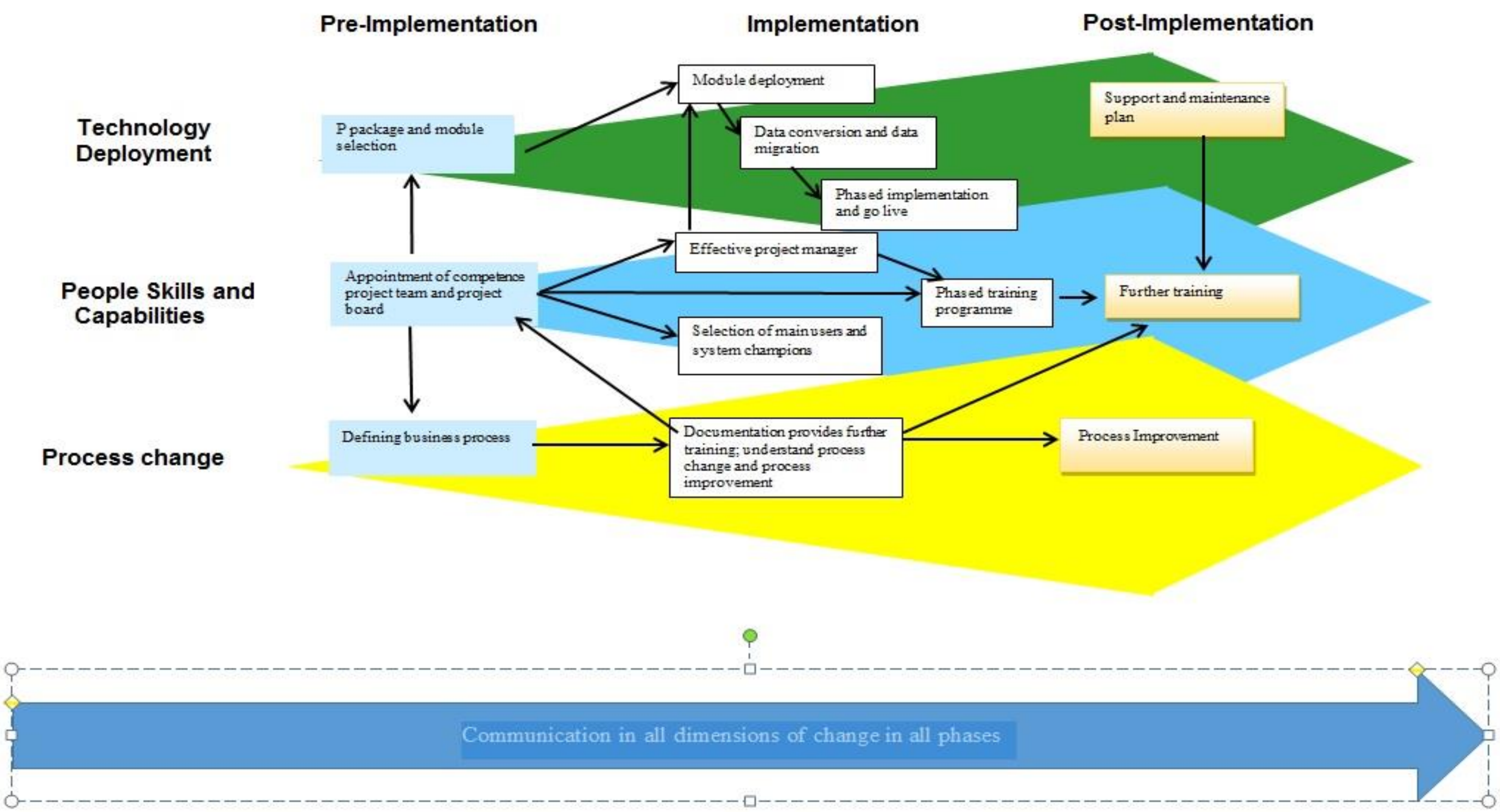


Figure 48: IS Implementation Model in Manufacturing SMEs in Iran

7.5 Contribution to Knowledge

The IS model (see Figure 48, above) has been developed based on the findings from the three case studies. Within this study, three main dimensions of change and general elements of ERP implementation success factors in discrete manufacturing SMEs in Iran have been identified. The specification of a new framework for a successful ERP implementation in discrete manufacturing SMEs in Iran has been developed. The model introduces the main dimensions of change and change elements that should be considered during an ERP project in Iranian SMEs. In order to justify why these changes should be considered during an ERP project, reference has been made to the available models in the literature and findings of this research.

This study developed a conceptual model based on models in the existing literature, such as those of Heeks (2000), Parr and Shanks (2000), as well as utilising success factors derived from the literature. As such, the researcher's aim was to combine the concept of dimensions of change (found in Heeks) and the implementation phases (found in Parr and Shanks, and others) with critical success factors found in the literature. Based on this approach, the researcher developed a final model that not only combines the main dimension of change and ERP implementation phases, but also shows the relationships between the success factors during each phase and dimension of the model, to better support the IS implementation practices of SMEs in discrete manufacturing industries in Iran (Figure 49, below).

In terms of a practical contribution to knowledge for the companies involved in the case study and for Iranian companies contemplating ERP implementation, the IS implementation model allows companies to plan their time and resource allocation more efficiently and effectively. After completing the model, the researcher shared it with the case study companies: only one responded with feedback, which was IBC. According to this feedback, the model enables them to identify areas they need to consider for further resource allocation in future, and they acknowledge that had it been available when they were planning ERP adoption it would have helpful in some important ways. For example, through the company's email response and a telephone conversation with participant at IBC it emerged that the model would have been helpful with sequencing activities in a process of ERP implementation and would assist companies with synchronising the phases of each dimension to keep them in balance. For example, a company could purchase a lot of expensive IT equipment in preparation for ERP implementation, but if it has not completed staff training on using this equipment that investment could quickly be squandered. Moreover, if staff training is inadequate staff may revert to using old systems on the new equipment, leading to incompatibility between systems used by different departments in the same company. However, the feedback from IBC did state that while the company recognised the need for documentation of the ERP implementation process, it nevertheless regarded this as too expensive, suggesting that the model offers a pathway to avoid conflicts within an IT process but practical considerations will always impinge on decision making as well as theoretical advantage. The conceptual elements that contributed to the development of the final model are outline in figure 49 below.

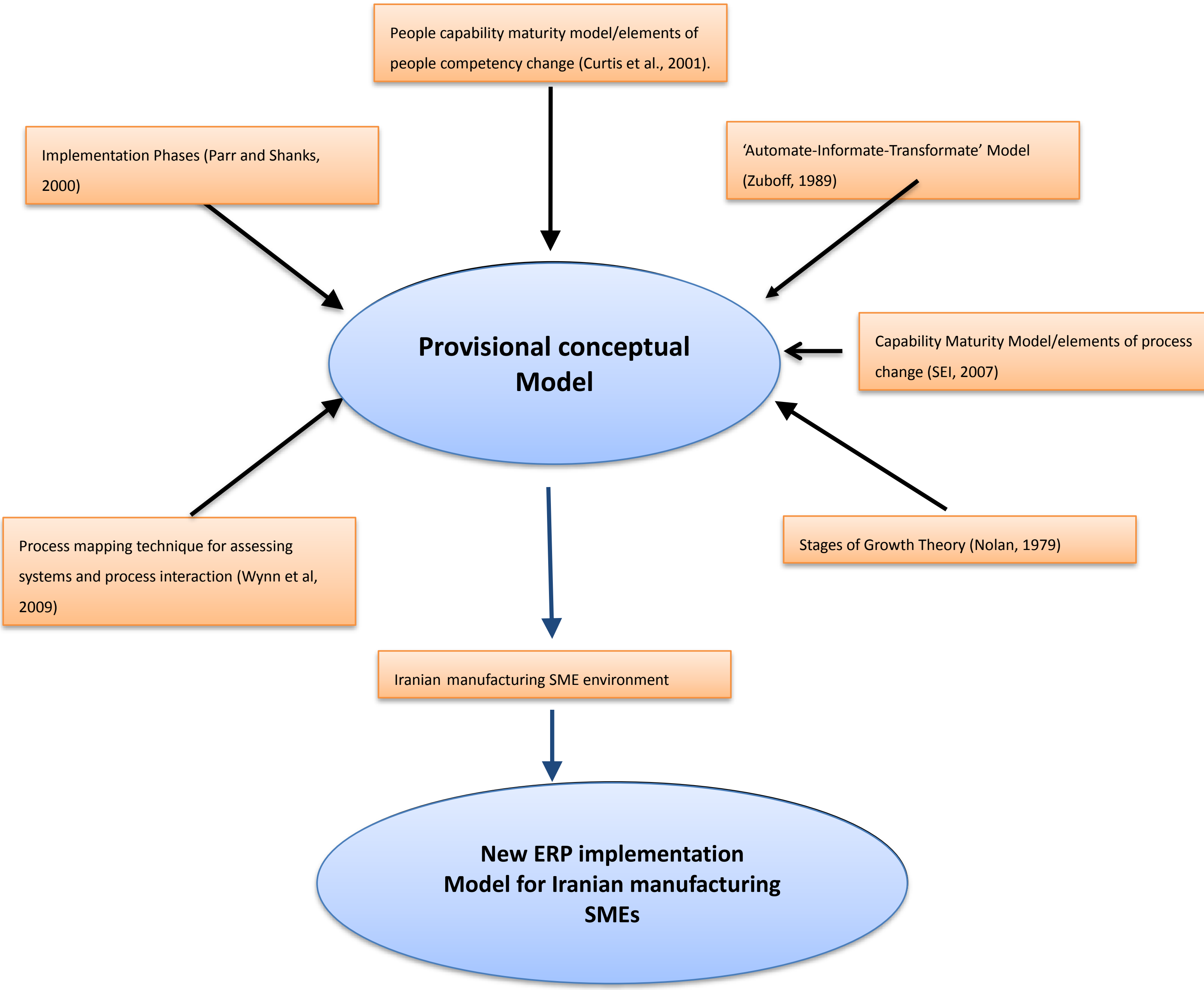


Figure 49: Theoretical foundations for development of the new model

Findings from the cases reinforce the relevance of balancing change in the three dimensions of technology, people, and process in ERP implementation success in discrete manufacturing SMEs in Iran. The findings indicate that the success of an ERP project depends on individual change elements within these dimensions. The model (figure 48) reflects the nature of ERP implementation in discrete manufacturing SMEs and identifies the particular elements that should be considered during the ERP project. The model helps future researchers to understand why these dimensions of change affect the implementation process.

The model depicted in Figure 48 can thus be seen as a contribution to knowledge to be set alongside the model of King-Turner (2014) and the major theoretical conceptual contribution of Heeks (2002), Parr and Shanks (2000) and others shown in Figure 49. The model combines elements from all these sources, and provides a theoretical and practical underpinning for ERP implementation in a developing world context. As such, it is a new contribution to knowledge in the ERP systems field in developing world manufacturing company environment.

7.6 Contribution to Practice

The results of this research can be applied to other manufacturing SMEs in Iran wishing to implement an ERP system. The identified elements of change in the conceptual model and the findings of the research regarding successful implementation can benefit other IT/IS professionals and practitioners working or operating in Iran. The elements highlighted in this study can provide practitioners with guidelines to manage the implementation process in line with the specific conditions of manufacturing SMEs in Iran. Other businesses can use the change elements highlighted in this research as examples of best practice that may be applied in other business contexts.

The case study findings allied to the conceptual model point to how the success of ERP implementation is influenced by the alignment of technology, people and process change dimensions, and their associated change elements. Understanding how these dimensions and their elements of change affect the ERP project is essential for practitioners. Case study findings suggest that involvement of users and setting up a competent project control team are key issues that affect the decision-making process and ERP project. This may have implications for other manufacturing sectors that are in the process of implementing ERP systems.

The model (figure 48) can be utilised in the context of the ERP vendor- manufacturing user negotiations and subsequent implementation support. The model can help vendors and SMEs to understand success factors and their relevance and sequence in terms of the different dimensions and phases that IS implementation necessarily involves. The majority of success factors identified by this study are mentioned in the literature; however, after data collection all these factors been reviewed, with the most critical included in the final model to align with the requirements of discrete manufacturing SMEs in Iran.

Practitioners can avoid unnecessary customisation by performing due diligence when identifying business needs and defining business processes to confirm that a selected package aligns with the business processes. Practitioners and organisations should allocate enough time to understand business process change, and goals and objectives of the project to align the business processes with the embedded business model and associated procedures in the selected package.

SMEs need to improve the recruiting procedures and standards regarding employees' level of IT and computer literacy to support the implementation process and the new system. Furthermore, they need to work closely with their vendor to identify future maintenance, upgrade and support; this process could be greatly improved if both company and vendor keep up-to-date documentation of the processes.

Ultimately, the model (figure 48) can help managers to focus on these changes and target their decisions on improving communication and involving users during each phase. Given that these elements are based on discrete manufacturers in Iran, Iranian manufacturers can consider these change dimensions and elements and use them as a template for ERP project management.

7.7 Limitations

There were certain limitations throughout this research study. Yin (2009) asserted that case study research is a long process and the findings can be massive and in some cases unreadable (such as statements in questionnaires). The fact that this study was conducted in manufacturing SMEs in Iran resulted in extensive English and Parsi translations. Further limitations arise from the time difference between countries, which affected the data collection process. For example, the researcher was unable to find the specific person for an interview. Another limitation was the geographical locations of case studies in Iran and cultural differences in how family businesses operate. Due to the traditional and cultural family business environment of secrecy, it was difficult to get some respondents to answer some questions (e.g.: annual turnover) and also many answers needed a director's approval.

The lack of standard procedures in most private companies in Iran, and their lack of knowledge regarding process change and process management resulted in some uncertainty regarding answering some questions. For example, they did not answer or they just answered "yes" or "no". In some cases, this resulted in a longer interview process in order to gather more information regarding questions.

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Appendix 1

Survey Questions:

Dear Sir/ Madam,

I invite you to participate in a research study based at the University. I am currently PhD student at University of Gloucestershire. The purpose of this survey is to investigate current IT situation of Iranian SMEs. This is part of research study. The information provided will be used as the foundation for the preparation for further questions.

If you have any queries regarding this survey, please do not hesitate to email: s0808087@connect.glos.ac.uk

Thank you for your time and co-operation.

Maryam Rezaeian

1. **Do you have any information systems (IS) in your company? (Please select and briefly explain why you implemented the information systems), if not are you willing to have new IS? Please explain.**

   ☐A: ERP solution (such as SAP)

   ☐B: Total or integrated system (such as Behko)

   ☐C: Other information systems (either packages such as CRM or bespoke applications) (please specify)

   ☐D: No computerised solutions (i.e manual systems only)

2. **If yes, would you be willing to fill in a questionnaire to give us further information that will be used in the research project?**

   ☐Yes (please provide your contact details)

   ☐No

Survey Follow up Interview:

1- You have claimed, you don't have any IS solution in your company, do u have any plan to implement an integrated solution or any other IS? If yes, have you selected any?

2- You have claimed you have integrated solution. Would you like to upgrade your current software, or add some other modules? If not, what is the reason?

3- You have claimed you have total or integrated software, can you explain what prompted you to do so?

Questionnaire

Questionnaire regarding IS and ERP deployment in manufacturing SMEs in Iran

Informed Consent Form

Questionnaire brief:

The purpose of this questionnaire is to investigate and assess the level of information systems (IS) and/or enterprise resource planning (ERP) adoption at manufacturing small-medium sized enterprises (SMEs) in Iran. The information gained from this questionnaire will help the researcher to answer research questions that are part of her doctoral thesis at the University of Gloucestershire, UK. All references to individuals will be anonymised; the real names of individuals will not be used, neither in the thesis nor in any related work.

The questionnaire will take approximately 45 minutes to complete.

Many thanks for your assistance.

If you have any queries or questions regarding this questionnaire please do not hesitate to contact:

Maryam Rezaeian, University of Gloucestershire

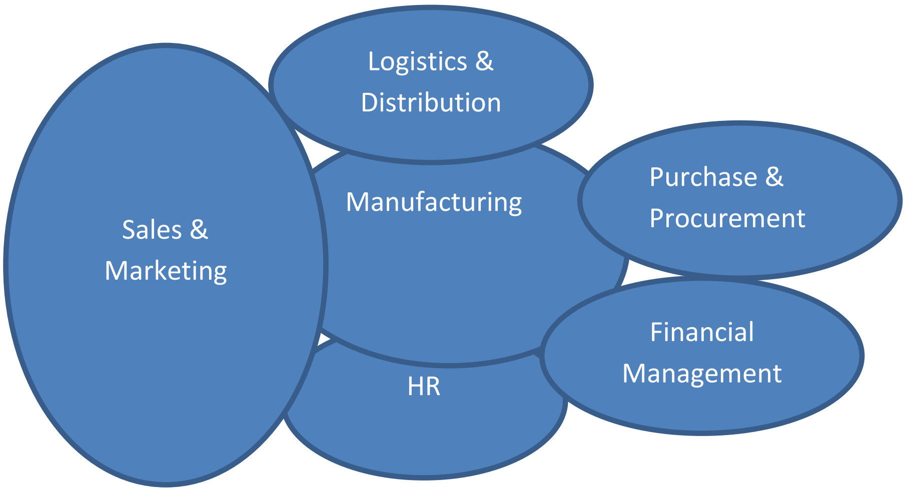
Email:

Mobile:

Participant Name and Signature:

Job Role in Company:

Date:

Section 1: General Company Information	
1	When was the company founded?
2	Could you briefly state the company's core business?
3	What are the main departments in your company? (e.g. Sales & Marketing)
4	Are you working at the company main site? Do you have other sites?
5	Do you have staff that work remotely? (E.g. sales staff)
6	In total how many employees do you have? And how many of them are working in your IT department?
7	What is the present annual turnover of the company?
8	Is the company profitable? Is it possible to mention how much profit you made last year?
9	What are your company's main business objectives for the next 5 years?
10	What are the objectives and plans for investment in information technology (IT) and information systems (IS) for the next 5 years?
11	Do you think the investment in information technology is adequate to support the growth of the company and its objectives? If yes, please explain how?
12	Please provide some background/history regarding the use of computers, systems, networks and websites at the company.
13	The diagram below provides a possible view of the main business processes in your company. A business process may be seen as a set of activities that cut across the functional and physical divisions of the company. Please make any comments on this top-level process map. Does it adequately represent what goes on in the company? Please add, change or delete? 

14	Does the company use email both internally and externally? Please comment:
15	Does the company have a website, and what is it used for in general terms?
16	Does the company have its own intranet for internal use by its own staff? Please comment:
17	Is mobile technology (laptops, iPad, iPhone) used within the company both internally and externally to send and receive emails or for data recording in the field? Please comment: .
18	How many personal computers, laptops and servers are used in the company? Are they linked by networks (either hard-wired or WIFI)? What systems run on the servers? Please comment:

The following sections focus on the ERP/ Total system project based on three dimension of change (Technology, People, and Process). Each section has three phases including pre-implementation phase, implementation phase, and post- implementation phase.

The pre implementation phase questions focuses on company status before start of the project from different dimension of change.

The implementation phase focuses on the actual implementation process considering variety of change elements.

The post- implementation phase focuses on the status of RRP project after implementation to understand the level of project success.

Section 2: Technology **This section covers communications, hardware, and e-business aspects to understand the company's level of technology adoption.**	
Pre- Implementation Phase	
1	What systems and hardware did you have before the ERP implementation? Were they integrated or standalone systems?
2	How good were they? Did they support business process adequately?
3	Were all system manual or did they have some computerised?
4	Were there any problems with data accuracy, consistency and integrity within the organisation? (If so, please state in which area)
5	Were there any issues concerning the multiple maintenance of key corporate information? For example was customer data or product data updated in more than one system?
6	Could data only be updated in one particular system or was there real time or batch updates between systems?
7	How was your data conversion process for the ERP project? Did you have problems transferring data and receiving data?

8	Did you have any customisation on the system, if yes when was this done and were code changes required? Did you have bespoke requirements that the software provider had to prepare specially?
Implementation Phase	
9	Which modules did you implement? Why? Did you have any plan on how to implement them? Did you have any issues?
10	Did you identify required reports during the project, please explain?
11	How was your data migration process? Did you have problems transferring data and receiving data?
12	Did you start the deployment from a specific department? Why?
13	Do you have any system owner to monitor and lead the system? What was his role, please explain?
14	What was the operating system?
15	What was the database platform? (Oracle, MY SQL)
16	For your IS and/ or ERP solution what was your implementation timescale? Have you finished implementation according to your timescale? If yes what do you think was helping the process? If not what was the main issue that delayed the process?
17	What was the overall cost of implementation?
Post- Implementation Phase	
18	Since you have done implementation have you had any upgrade or maintenance - please explain.
19	Are there any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area.
20	Are you content with your current network architecture or are you looking for some further upgrades in the future? Please explain.
21	Can data only be updated in one particular system or is there real time or batch updates between systems? Please explain.
22	Are there still any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area.
23	Does the current level of integration support the organisation's strategies? Please explain.
24	What are the key business challenges in the company? (Duplication of files/documents, Duplication of efforts in generating a report, spent a lot of time in retrieving a document, No central contact database, Business processes are not integrated, Remote workers struggling to access company information Difficulty finding the latest and relevant documents on current system)
25	Have you customised any module? If so on which modules and why
Section end	

Section 3: People This section will examine people skills and their readiness for change across the organization.	
Pre- Implementation Phase	
1	What was the level of IT and computer literacy before ERP implementation?
2	Did you have an IT department? How many IT staff did you have? Did you recruit new IT staff for new project?
3	Did you identify main users and system champion before starting the project? What was your selection basis?
4	Did you set up the project team and project board before starting the project? If yes what was the impact of having them?
5	Do you think the main elements of the systems project were adequately explained prior to the start of implementation?
Implementation Phase	
6	What do think regarding management involvement? Was it supportive? Please explain how.
7	Changes introduced in companies generally cause some kind of resistance from employees. Has your company faced any resistance from the introduction of an IS and/or ERP system? Please explain.
8	Did you involve the main users in the whole change process? Did you explain the scope of the project to them? Did you communicate clearly with all users throughout all processes? Please explain.
9	Did you have to change any employee’s role? Or recruit new employees for the new system? Does the new system affect your employee job description and how?
10	What do you think regarding having a project manager during ERP project?
11	How many users were there for each module?
12	Who was on the implementation team? Did you use third party contractors
Post- Implementation Phase	
13	Have you assessed user satisfaction and how?
14	Do you provide regular training in case of upgrade or changes?
15	Do you provide training for new users?
16	Do you think the employees are now comfortable using new systems and associating changes in processes and procedures? Have they adapted well to this change?
17	What do you think regarding the difficulty level of system support (including maintenance and upgrades) at the post implementation stage in your company? Please explain.
Section end	

Section 4: Processes	
Pre- Implementation Phase	
1	How effective were your main business processes as identified in section 1?
2	Were they manual or automated? Please explain.
3	Were there any major inefficiency? Please explain
4	Was there any documentation in place?
Implementation Phase	
5	Did you Have any documentation of your process during the implementation? If yes could you please explain one of your company's main business processes? How it does work? (E.g. Manufacturing)
6	Did they become standardise? Was there any standard way of doing the business processes?
7	Did you have to change your processes because of the way the system works?
Post- Implementation Phase	
8	Did you identify any process owner for each process? If yes please explain for what reason they have been selected?
9	Have you reviewed or modified existing process documentation for further adjustment? If yes please explain.
10	Are the business processes now adequately support the ERP? Please explain.
11	Is there scope for further process reengineering? Please explain.
Section end	

Section 5: Additional information
Please use this section to give any further information relevant to this research.

IBC Questionnaire

Questionnaire regarding IS and ERP deployment in manufacturing SMEs in Iran

Informed Consent Form

Questionnaire brief:

The purpose of this questionnaire is to investigate and assess the level of information systems (IS) and/or enterprise resource planning (ERP) adoption at manufacturing small-medium sized enterprises (SMEs) in Iran. The information gained from this questionnaire will help the researcher to answer research questions that are part of her doctoral thesis at the University of Gloucestershire, UK. All references to individuals will be anonymised; the real names of individuals will not be used, neither in the thesis nor in any related work.

The questionnaire will take approximately 45 minutes to complete.

Many thanks for your assistance.

If you have any queries or questions regarding this questionnaire please do not hesitate to contact:

Maryam Rezaeian, University of Gloucestershire

Email:

Mobile:

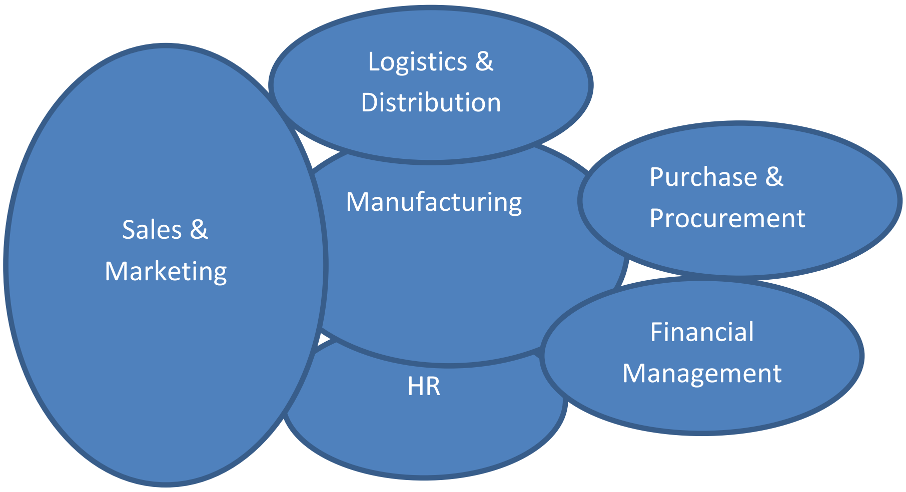
Participant Name and Signature:

Job Role in Company:

Date:

Section 1: General Company Information	
1	When was the company founded? family business Founded in 1985
2	Could you briefly state the company's core business? Design, manufacture and distributes city bus, midi bus, mini bus, van and spare parts
3	What are the main departments in your company? (e.g. Sales & Marketing) Finance, Commercial (sales and marketing/ purchase and procurement), Human Resources, Engineering, logistics and distribution, and shop floor and production line department.
4	Are you working at the company main site? Do you have other sites? Yes, they all working in main company, there is no other site however there are independent distributor distributer agencies and after sales services in most cities in Iran
5	Do you have staff that work remotely? (E.g. sales staff) No
6	In total how many employees do you have? And how many of them are working in your IT department? 350, 5 in IT
7	What is the present annual turnover of the company? Approximately £100000
8	Is the company profitable? Is it possible to mention how much profit you made last year? N/A
9	What are your company's main business objectives for the next 5 years? R1: invest in manufacturing new buses and minibuses, and be the first manufacturer in middle east and Iran, expand the business globally R2: increase the sales to government and other sectors based on their requirements and also to expand business globally to become a leading manufacturer in the Middle East R3: invest in manufacturing new buses and minibuses, increase the sales and marketing. We have many competitors, so we need to make sure we keep our price down with better quality and also we need to innovate new designs and increase production volume.
10	What are the objectives and plans for investment in information technology (IT) and information systems (IS) for the next 5 years? R1: replacing the remaining manual systems, to make company processes as efficient as possible, and reduce employee numbers, invest more on training

11	Do you think the investment in information technology is adequate to support the growth of the company and its objectives? If yes, please explain how? R1: Yes, current system increased the company performance R2: yes, current investment save lots of time and decrease duplication, now many departments can talk together easily. R3: yes, investment on IT helps to increase production lines and save lots of time, easy communication between departments.
12	Please provide some background/history regarding the use of computers, systems, networks and websites at the company. SHOMARAN, 1 server for both software and database. No website, 12 computers with 18 uses. Using internet for research and sending emails (Wifi) R1: back up was weekly, same access for users, system admin was third party, and users used their own personal emails. Windows 7 operating system , MS office BEHKO current system R1: All the BEHKO system modules are integrated; however, they are not integrated with other processes using Excel/ Access or SEVEN in information system. The BEHKO system was developed in C++ and uses the SQL database
13	The diagram below provides a possible view of the main business processes in your company. A business process may be seen as a set of activities that cut across the functional and physical divisions of the company. Please make any comments on this top-level process map. Does it adequately represent what goes on in the company? Please add, change or delete?

	
14	Does the company use email both internally and externally? Please comment: yes company use ZIMBRA as an internal email server and also they have external email (All departments are connected via intranet)
15	Does the company have a website, and what is it used for in general terms? Yes, it is for adverting products and company news
16	Does the company have its own intranet for internal use by its own staff? Please comment: yes, it connects all computers together, we can share files, and use for printing.
17	Is mobile technology (laptops, iPad, iPhone) used within the company both internally and externally to send and receive emails or for data recording in the field? Please comment: No, users have their own personal, but there are some laptops and several iPad for meeting use.
18	How many personal computers, laptops and servers are used in the company? Are they linked by networks (either hard-wired or WIFI)? What systems run on the servers? Please comment: 100 computers, 20 laptops and 5 servers with cable or Wi-Fi (All PCs run by Windows 10 operating system and MS office)

The following sections focus on the ERP/ Total system project based on three dimension of change (Technology, People, and Process). Each section has three phases including pre-implementation phase, implementation phase, and post- implementation phase.

The pre implementation phase questions focuses on company status before start of the project from different dimension of change. The implementation phase focuses on the actual implementation process considering variety of change elements. The post- implementation phase focuses on the status of RRP project after implementation to understand the level of project success.

Section 2: Technology **This section covers communications, hardware, and e-business aspects to understand the company's level of technology adoption.**	
Pre- Implementation Phase	
1	What systems and hardware did you have before the ERP implementation? Were they integrated or standalone systems? SHOMARAN was the first system adopted in 2003, and was integrated software. This system implemented on finance and sales. The rest of the systems were semi manual using spreadsheets and Microsoft office. The process were finance (with 5 users and 3 PCs), sales (6 users and 4 PCs) , purchase (4 users and 2 PCs), logistics (2 users and 1 PCs), and production design (used CAD with 3 users and 2 PCs)
2	How good were they? Did they support business process adequately? No, R 2, 3: it had not had enough capability. R1: The system also had not been developed well based on departmental needs. Besides lack of integration, the data accuracy and duplication was another problem, which had negative impacts on production line efficiencies, decision making and customer service. There was also a lack of security and privacy, we had only one server to manage both software and database which was not secure. The database backup was scheduled weekly on the same server. All available PCs ran with the Windows 7 operating system and MS office. There was no electronic central system that connected to the various sub- systems. We did not have email service for users to communicate, and users used to use their personal email.There were some internal and external issues For example, poor internet connection affected communication within departments; for example, employees were sometimes unable to contact each other by email. Company needed to provide hardware that was compatible with a standard industrial environment, because the operation of heavy machines on the shop floor affected the stability of nearby buildings R2: The key issue was inconsistent product information (for example there was not any specific product name or part number for each product), with the resultant "incorrect production" and "incorrect order" errors.
3	Were all system manual or did they have some computerised? SHOMARAN was automated and rest of the system were semi manual using speared sheets and Microsoft office

4	Were there any problems with data accuracy, consistency and integrity within the organisation? (If so, please state in which area) Yes, R 1, 2, 3: Because user access and privileges for all users including heads of departments was the same, and all users had the same username and password. System admin was undertaken by a third party from the vendor company. R1: Having third party was not idea entering wrong data by users, data duplication interring by different users, inefficiency of users by entering wrong data. I was too busy to monitor and audit database regularly
5	Were there any issues concerning the multiple maintenance of key corporate information? For example was customer data or product data updated in more than one system? R1: SHOMARAN could not be updated, all changes was under finance manager control.
6	Could data only be updated in one particular system or was there real time or batch updates between systems? No. R1: Operating system and antivirus software had not been updated.
7	How was your data conversion process for the ERP project? Did you have problems transferring data and receiving data? R1: For SHOMARAN system, all data was paper works and spread sheets. Because it was only 2 modules it was quick. For BEHKO, software provider arranged it by special software. Because of existence of paper work documents and spread sheets (multiple sources) it took time. One of the main issues during data conversion was duplication and the conversion process meant that some work was done twice. This was because of the inconsistency in the legacy system. During data conversion the common error used to appear on the screen as “failed to load, correct the data and run again”. Vendor arrange a meeting to to understand the way data added to be used in new system , R2: it was time consuming as we needed to codify all the parts in manufacturing R3: It needed some re work, but after that it works fine.
8	Did you have any customisation on the system, if yes when was this done and were code changes required? Did you have bespoke requirements that the software provider had to prepare specially? Not for SHOMARAN, but we had for BEHKO for Inventory, yes it neds code changes because we need to add function to module. R1: The standard BEHKO package takes demand for a product and generates the bill of materials (BOM) to advise the purchasing, inventory and shop floor personnel; but the system could not cater for the different steel thicknesses

	required. This was introduced through customisation of the ERP prior to its implementation. This helped data conversion for other modules as they could easily define the necessary raw materials and components in other modules
Implementation Phase	
9	Which modules did you implement? Why? Did you have any plan on how to implement them? Did you have any issues? BEHKO Implemented 2008. Sales and marketing, Purchasing and procurement, Manufacturing, Financial, Logistics, HR R1: Company sales increased so we needed to automate the processes to make it faster to cope with demands. Yes inventory was our priority, it was stage by stage, first we implement inventory, the rest of modules implement at the same time. It took 3 years, we have to stop after inventory implemented due to the lack of financial.
10	Did you identify required reports during the project, please explain? Yes: inventory report, finance, BOM. R1: the most important one was inventory. before we had not have consistent report and we needed to get staff to do stack checking system is capable to generate reports for all modules, just need to enable it
11	How was your data migration process? Did you have problems transferring data and receiving data? R1:Software vendor converted the data and during implementation they migrated the data. 3 source of data, from SHOMARAN system, paper works and spread sheets R2, 3: Head of each department were monitoring data migration of key business information and supervise the main user. All these activities were overseen by the project board.
12	Did you start the deployment from a specific department? Why? Yes, from inventory to establish consistent inventory product codes and simplifies and standardise product information for both internal processes and also for customer facing sales and marketing departments Then we implemented rest of the module. R1: We needed to have a consistent data for our stocks and components; this helped later for deploying rest of modules. R3: Phased implementation allowed staff to adapt to the changes in systems and procedures in an orderly and controlled manner
13	Do you have any system owner to monitor and lead the system? What was his role, please explain? Yes, head of each department responsible for their own and IT manager and senior managers can administrate whole system. Data based administrator control, maintain and upgrade the system.
14	What was the operating system? 5 servers with operating system Windows 2012 R2, on-premises. system developed in C++

15	What was the database platform? (Oracle, MY SQL) Microsoft SQL Server 2008
16	For your IS and/ or ERP solution what was your implementation timescale? Have you finished implementation according to your timescale? If yes what do you think was helping the process? If not what was the main issue that delayed the process? It was 2 years; no we could not, financial problem or in some cases some main users left and the company needed to replace them. It took 3 years whole implementation (Gant Chart, figure 21) R3: the delays did allow users to familiar themselves with new system and associate procedures.
17	What was the overall cost of implementation? software only £ 50000
Post- Implementation Phase	
18	Since you have done implementation have you had any upgrade or maintenance - please explain. No, finance problem R1: planning a major upgrade to the BEHKO ERP product in 2017 to improve functionalities, which was expected to allow the replacement of the SEVEN package and other standalone applications; however, this depended on the available budget for IT.
19	Are there any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area. R2, 3: No R1: yes, because of transferring data from multiple paper-based systems, there was inconsistency and lack of accuracy on legacy data. However, the interview findings revealed that the vendor tried to convert the data; they had not determined which legacy data was fit for moving to new system.
20	Are you content with your current network architecture or are you looking for some further upgrades in the future? Please explain. Yes, no need for upgrade
21	Can data only be updated in one particular system or is there real time or batch updates between systems? Please explain. The data in each module can be update by system admin only and any update will be updating the other modules as well.
22	Are there still any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area. NO
23	Does the current level of integration support the organisation's strategies? Please explain. for the processes that automated with BEHKO is good, but we need to automate HR and specially distribution completely.

24	What are the key business challenges in the company? (Duplication of files/documents, Duplication of efforts in generating a report, spent a lot of time in retrieving a document, No central contact database, Business processes are not integrated, Remote workers struggling to access company information Difficulty finding the latest and relevant documents on current system) Power cut in the main problem. We recently bought UPS (un-interruptible power supply) which is really helpful.
25	Have you customised any module? If so on which modules and why? in inventory for Steel thicknesses
Section end	

Section 3: People This section will examine people skills and their readiness for change across the organization.	
Pre- Implementation Phase	
1	What was the level of IT and computer literacy before ERP implementation? IBC: we had to recruit Head of IT, IT support, data base administrator. The most users have good knowledge of computer literacy R1: it was more difficult to transfer knowledge to the employees with less computer literacy. R2: willingness of the company's IT department to learn had a huge impact on smoothing the training.
2	Did you have an IT department? How many IT staff did you have? Did you recruit new IT staff for new project? No, yes, we needed to recruit 3 IT supports and one database administrator. All IT advisors have BA in computer science and have a good knowledge of Oracle and SQL database as well as C++ and JAVA. Database administrator is also qualified in computer science and experienced in programing language and analysing systems.
3	Did you identify main users and system champion before starting the project? What was your selection basis? yes we chose the people that have more effect on others

	R1: selection of system champions was based on the individual's charismatic personality and skills, which was of great help to the vendor in the training process. Identifying system users smoothed the project process.
4	Did you set up the project team and project board before starting the project? If yes what was the impact of having them? Yes. R1: They smooth the decision making
5	Do you think the main elements of the systems project were adequately explained prior to the start of implementation? Yes: R1: I was heavily involved in supporting main departments in specifying their requirements and in package selection. In implementation phase, I had regular meetings with department heads to progress check and make sure they understood the implementation process. I also formally was announced as project coordinator. I was assisting project manager in planning and managing activities. I was also participating in managing training and assisting in training workshops. The IT consults have been provided a full workshop of all aspects of BEHKO to assist in implementation process. IT consults also assisting in training. R2: In order to streamline the processes and sub-processes in the business, a detailed training programme was scheduled by the project board and project team. A new position of IT consultant was added to the organisation, and an IT project manager was selected by BEHKO. I was responsible for selecting and implementing the Total Systems solution. As main user and responsible for overall project quality, I represented individual departmental needs, and met with the Head of IT regularly. R3: I worked closely with the Head of IT in the selection and implementation processes, identifying and planning training for most of the staff. Main users from each department were selected by head of department for training on key functional aspects of the new system.
Implementation Phase	
6	What do think regarding management involvement? Was it supportive? Please explain how. Yes, their support decrease the users resistance
7	Changes introduced in companies generally cause some kind of resistance from employees. Has your company faced any resistance from the introduction of an IS and/or ERP system? Please explain. R1: Yes, most old users used to resist learning or using new system. Some users at the star of the project were worry to lose jobs, but soon they try to learn to compete with colleagues. R3: the most difficult level of system support was how to satisfy the users and encourage them to learn and share the new knowledge.
8	Did you involve the main users in the whole change process? Did you explain the scope of the project to them? Did you communicate clearly with all users throughout all processes? Please explain. Yes each department had meetings every

	couple of months and head of department was responsible to explain all the scope and changes.
9	Did you have to change any employee's role? Or recruit new employees for the new system? Does the new system affect your employee job description and how?no, we had new rolls for new employees, company could not sack any one due to the contracts had with employees. However we did not have to because company demands increased so, we needed them to cope with demands.
10	What do you think regarding having a project manager during ERP project? software vendor project manager, it was effective he use to work with the IT manager. Having someone from outside help the IT manager to have more time for users. IT manager and project manager worked together for implementation.
11	How many users were there for each module? Sales and marketing: 20, purchase: 15, manufacturing: 12, financial 10, personnel management: 6, inventory: 6, internal distributor: 5, quality control 10, engineering 15. Each user has 1 computer.
12	Who was on the implementation team? Did you use third party contractors? Head of each department, project manager and consultant from software provider.
Post- Implementation Phase	
13	Have you assessed user satisfaction and how? No, but resistance is at the minimum level.
14	Do you provide regular training in case of upgrade or changes? Yes, we provide some reminder training in start of each financial year if the user requests it. But we have not had any upgrade yet. For new users we try to use our own staff to save money.
15	Do you provide training for new users? Yes, For new users we try to use our own staff to save money.
16	Do you think the employees are now comfortable using new systems and associating changes in processes and procedures? Have they adapted well to this change? Yes, older users found it difficult at the start.
17	What do you think regarding the difficulty level of system support (including maintenance and upgrades) at the post implementation stage in your company? Please explain. Because software vendor located in the same area as company, maintenance was not any problem, also data base administrator is always supporting maintenance. In post implementation we only tried to keep training in the loop.

Section end

Section 4: Processes	
Pre- Implementation Phase	
1	How effective were your main business processes as identified in section 1? We are very happy with new system, system helped us for production, inventory, process for personnel information is saved lots of time for company.
2	Were they manual or automated? Please explain. All processes are automated; however the training, health and safety (Part of HR) and agency distribution (part of Logistics) are manual. Also Primary distribution and after sales service is automated with off the shelf software called SEVEN
3	Were there any major inefficiency? Please explain Some problems with SEVEN as is not integrated with BEHKO, when customer makes order, if it is for after sales service or agencies we need to inter data separately for this system. And also for agencies users need to take the order and send it to inventory so it is take time.
4	Was there any documentation in place? No
Implementation Phase	
5	Did you Have any documentation of your process during the implementation? If yes could you please explain one of your company's main business processes? How it does work? (E.g. Manufacturing). No R1: each BEHKO module has a range of functionality; however, users only used the function they have been trained on and many of the available functions were not being used by the company.
6	Did they become standardise? Was there any standard way of doing the business processes? It is a routine we follow, but I cannot call it standard as it is different for any company.
7	Did you have to change your processes because of the way the system works? No, only the processes are automated now , for example before we used to go to inventory department to make or order but now is automated so when we inter data and request purchase, it is automatically going to purchase , inventory, and finance
Post- Implementation Phase	
8	Did you identify any process owner for each process? If yes please explain for what reason they have been selected? Head of each department
9	Have you reviewed or modified existing process documentation for further adjustment? If yes please explain. No this is expensive and time consuming.

10	Are the business processes now adequately support the ERP? Please explain. Yes. We manage to deliver our contract with government very well.
11	Is there scope for further process reengineering? Please explain. No, system and processes works fine
Section end	

Section 5: Additional information
Please use this section to give any further information relevant to this research.

IBC Interview

1. Who are your main customers? Municipalities and rural management org, Public Transport and Urban Traffic of the Country's Municipalities and Village Administrators, Transportation and Terminals Organization, The Public Relations Association of Urban Buses Suburban bus system.

2. You mentioned you providing bus for government, dose government support companies for IS/ IT adoption? No, we are private company

3. You mentioned you have six processes, could you please explain the sub- processes for each processes?

   R1, 2, 3:

   a. Manufacturing: production planning and production, quality control, engineering
   b. Logistics: inventory. Primary distribution and after sales service, agency distributors
   c. Finance: finance
   d. HR: personnel management, training, Health and safety.
   e. Purchase: purchase
   f. Sales: sales and marketing

   R1: since IBC was launched, the company had no experience of any major information system packages, except the use of spreadsheets and Microsoft office packages

   R3: most of the business areas were manual. Because of this, management decided to implement an information system to help them to increase company performance.

   R1, R2, R3: we are happy with the system however in the inventory process BEHKO system did not compare the price for different suppliers.

4. You mentioned you have 5 servers, please indicated what they are for?

   R1, 2, 3: Database server, software server, backup server, webserver (Email) and antivirus server. Windows 2012 R2 are installed on all the servers. Microsoft SQL 2008 installed on database server, BEHKO modules run on software database server, email and website run on webserver, and finally database Backup and vital files archive on backup server every day. In addition we installed McAfee antivirus software on all desktop computers and antivirus server. Also all update manage by antivirus server.

R1: more server provide higher security, database backup scheduled weekly and third company undertook system admin. We had regular power cuts were the main issue that could affect their ERP implementation; therefore, so we provided an Uninterruptable Power Supply (UPS), which increased the confidence of users in the system and prevented production downtime that might otherwise have occurred.

5. Could you explain the level of access for system users? BEHKO Total system provided through web portal with drop list that enable the user to choose which subsystem based on their department to login. Therefore all users have their own personalised login details with different accesses and privilege. The head of each department can grant other users with extra or less permission. BEHKO administered by IT manger and senior managers who have access to all system can generate reports and invoices. The whole system is controlled, maintained, and upgraded by Database administrator (DBA).

   R1: we aimed to help the users to feel comfortable with the system and feel comfortable sharing their knowledge with different teams and different departments. Therefore, selecting someone with enough knowledge and with higher authority facilitated the training and finally the implementation process

6. Who were in your project team and project board? Project team included selected managers from across all departments - commercial, finance, production, engineering, quality control, and the IT manager. Also we selected system champion which built the trust of main users and even management. This helped the main users to feel more involved in the project and trust the system champions throughout the ERP project. Having a skilful project manager was one of the main success factors of the project.

   R1: understanding of the overall needs of the organisation help IBC to direct the project in the right line. Having a project team and project board smoothed the decision making processes, helping to identify the business processes, company scope and goals. He further claimed that having a project board and project team at the beginning of the project saved lots of time. Having a skilful project manager was one of the main success factors of the project. It also helped to identify project scope, plan the project time, and cost before implementing the system.

R3: The project team, with the consent of the project board, identified the main users and system champions. selecting main users allowed users to familiarise themselves with the new system and its associated procedures. And also engaging employees eased the changes in processes and that identifying main users and system champion increased the success of implementation. Having a skilful project manager was one of the main success factors of the project.

R1, 2, 3: provided an ongoing communication mechanism with its users at all stages of ERP implementation through system owners, system champions, and project team and project board.

7. What was your package selection procedure?

R1, 2, 3: Package selection was a formal decision made by project board and project team.

project team set up a committee from cross all departments(included commercial, finance, production, engineering, quality control, and the Head of IT).

R2: Committee was responsible to provide a shortlist of product from several vendors for a system demonstration. We selected BEHKO TOTAL system for further investigation, including a workshop for each module and detailed discussion on functionality, user requirements and price negotiation. BEHKO is an Iranian software company, and its selection was based on functionality, and language – it uses only Parsi– and easy access for systems support and upgrade. we customised logistic and distribution. Also we needed to consider the quality and availability of data. Reduce the duplication and inconsistency in product list.

R1, 3: The committee and project team focused on functionality of different software introduced by different vendors and tries to find out which product is aligned with company business process, alongside presenting and introducing each module to its main users in a planned sequence. It was good to have vendor in the same city that company located.

A note for Training:

R1: It was an expensive programme to engage in; however, it was essential for project success. Vendor found it very difficult to encourage older staff to learn the new system. The most difficult level of system support was how to satisfy the users and encourage them to learn and share the new knowledge. All users felt comfortable to use the system as they were trained well and knew how to work with system.

R3: The initial resistance of staff to the project had a negative impact on other users and company performance. The resistance was due to fear of losing jobs.

R1, 2, 3 : leadership role of senior managers in this context: if managers are open with their knowledge and share expertise, this openness spreads to other levels in the organisation and ERP systems can become integrated into daily work much faster.

ETS Questionnaire

Informed Consent Form

Questionnaire brief:

The purpose of this questionnaire is to investigate and assess the level of information systems (IS) and/or enterprise resource planning (ERP) adoption at manufacturing small-medium sized enterprises (SMEs) in Iran. The information gained from this questionnaire will help the researcher to answer research questions that are part of her doctoral thesis at the University of Gloucestershire, UK. All references to individuals will be anonymised; the real names of individuals will not be used, neither in the thesis nor in any related work.

The questionnaire will take approximately 45 minutes to complete.

Many thanks for your assistance.

If you have any queries or questions regarding this questionnaire please do not hesitate to contact:

Maryam Rezaeian, University of Gloucestershire

Email:

Mobile:

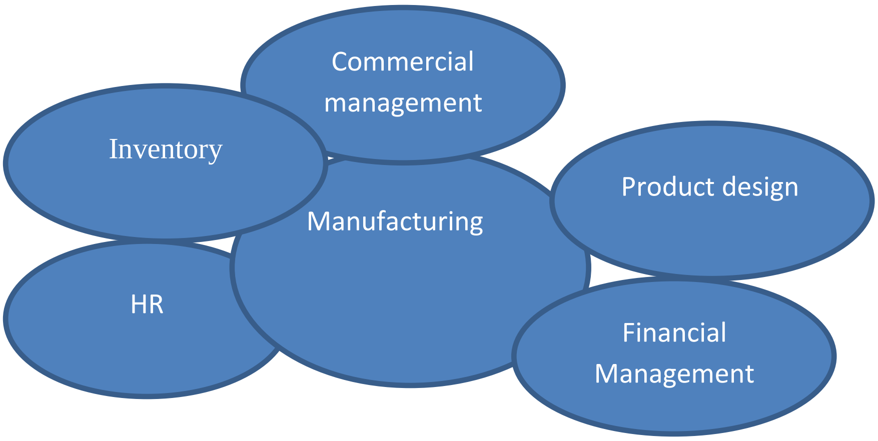
Participant Name and Signature:

Job Role in Company:

Date:

Section 1: General Company Information	
1	When was the company founded? family business Founded in 1987
2	Could you briefly state the company's core business Design, manufacture and distributes electronic vehicle, E-bike, assembled differential(for Pride, Nissan Jounior, Tiba), C.V Joint(for Pride), Pinion and Gear- differential, differential case, aviation, sleeves (valve) R1: Prior to the ERP project, the ETS process areas were supported by the Microsoft package and a range of spreadsheet and paperwork systems
3	What are the main departments in your company? (e.g. Sales & Marketing) Finance, commercial, HR, Distribution, Stock control, and Production and engineering
4	Are you working at the company main site? Do you have other sites? Yes, they all working in main company, there is no other site for productions, however they do have a main office in Tehran for sales and marketing
5	Do you have staff that work remotely? (E.g. sales staff) No
6	In total how many employees do you have? And how many of them are working in your IT department? 160, 1 Head of IT, and 1 system administrator
7	What is the present annual turnover of the company? N/A
8	Is the company profitable? Is it possible to mention how much profit you made last year? N/A
9	What are your company's main business objectives for the next 5 years? R1: improve production and company profit expanding sales to current and new customer to achieve an excellent customer service for current and new customer were the driver for deploying information system. R2: improve quality and sales and customer service increasing production with high quality standard not only increase sales, but also satisfy our customers.
10	What are the objectives and plans for investment in information technology (IT) and information systems (IS) for the next 5 years? R1: add IT department with enough IT advisor to help in system maintenance, upgrade, and training. R2: upgrade the system and provide suitable and enough training
11	Do you think the investment in information technology is adequate to support the growth of the company and its objectives? If yes, please explain how?

	R1: The company's 2013 business plan included proposals to automate processes across the company, but in particular, in the key process areas of production planning and finance. We needed to increase profitability, track and control costs. The management information in all areas of the company was processed by Microsoft package and a range of spreadsheet .lack of consistency, and duplication in all processes led to inefficient performance and loss of business time. Company was also open to a risk of data loss as there was no back up plan and policy in place. So the in the eventuality of data corruption, there would not be a restore point. So yes, the automated process are good but the manual system are time taking . R2: there is lots of duplication and mistakes because of manual data entering. Users not satisfied, as they don't know how to work with system. There was a dire lack of management information and process integration: it had proved very difficult to get accurate consistent information from existing system. As the company developed the product, the need to integrate processes came to the fore and led to the election of an ERP solution.
12	Please provide some background/history regarding the use of computers, systems, networks and websites at the company. Mostly used Microsoft office. And Auto CAD, Powermill . 1 server, 20 PCs (4 in finanace, 8 in commercial, 2 in distribution, 8 in production, and 18 in HR), 22 users. From last 2005 we start to use internet and have a website R1: Green/ Galax : 2 servers, 25 PCs (4 in finanace and 4 users , 8 in commercial and 8 users, 2 in inventoryand one user, 8 in manufacturing, product design 5 and 5 users, 0 in HR),
13	The diagram below provides a possible view of the main business processes in your company. A business process may be seen as a set of activities that cut across the functional and physical divisions of the company. Please make any comments on this top-level process map. Does it adequately represent what goes on in the company? Please add, change or delete?

	
14	Does the company use email both internally and externally? Please comment: yes, but is only for head of departments and specific users such as salse and purchase users. Others use their own personal email for external data exchange.
15	Does the company have a website, and what is it used for in general terms? Yes, it is for adverting products and company news
16	Does the company have its own intranet for internal use by its own staff? Please comment: yes, all computers are connected for sharing files and printing
17	Is mobile technology (laptops, iPad, iPhone) used within the company both internally and externally to send and receive emails or for data recording in the field? Please comment: No,
18	How many personal computers, laptops and servers are used in the company? Are they linked by networks (either hard-wired or WIFI)? What systems run on the servers? Please comment: 25 computers, 3 laptops and 2 servers with cable or Wi-Fi

The following sections focus on the ERP/ Total system project based on three dimension of change (Technology, People, and Process). Each section has three phases including pre-implementation phase, implementation phase, and post- implementation phase. The pre implementation phase questions focuses on company status before start of the project from different dimension of change. The implementation phase focuses on the actual implementation process considering variety of change elements. The post- implementation phase focuses on the status of RRP project after implementation to understand the level of project success.

Section 2: Technology **This section covers communications, hardware, and e-business aspects to understand the company's level of technology adoption.**	
Pre- Implementation Phase	
1	What systems and hardware did you have before the ERP implementation? Were they integrated or standalone systems? Mostly used Microsoft office. And Auto CAD, Powermill . 1 server, we did not have efficient report
2	How good were they? Did they support business process adequately? They were not accurate, duplicated data.
3	Were all system manual or did they have some computerised? No ¸ Mostly used Microsoft office. And Auto CAD, Powermill for product design
4	Were there any problems with data accuracy, consistency and integrity within the organisation? (If so, please state in which area) yes , it was a need to double check all the data
5	Were there any issues concerning the multiple maintenance of key corporate information? For example was customer data or product data updated in more than one system? Yes PCs most of the time had viruses and need to be repair
6	Could data only be updated in one particular system or was there real time or batch updates between systems? Systems were not connected and each system had separate update.
7	How was your data conversion process for the ERP project? Did you have problems transferring data and receiving data? R1: the data conversion procedure was based on software provider guidelines. Initially, the software provider requested ETS to define the company details. ETS stored all its company data in an excel worksheet called "ETS". All the parts were stored in an excel worksheet called "BOMs". Data conversion for processes that involved spreadsheets and Microsoft office was not difficult. However, any mistake and inaccuracy in the format provided by software provider could have delayed importing the data. Also due to the manual errors

	such as spelling mistakes, our using invalid characters like apostrophes, there was some delayed data import during implementation.
8	Did you have any customisation on the system, if yes when was this done and were code changes required? Did you have bespoke requirements that the software provider had to prepare specially? NO R1: GREEN/GALAX Modules were implemented without customisation company directors did not want to spend more on customisation and believed that the modules were able to execute ETS's business strategy.
Implementation Phase	
9	Which modules did you implement? Why? Did you have any plan on how to implement them? Did you have any issues? Commercial, Manufacturing, and Financial. No all modules deployed at the same time. When deployment finished all went live. It was difficult for training. R1: The information system strategy adopted at ETS is based on the GREEN/GALAX Total systems package, combined with point solutions developed in MS Excel. It was formal decision made by company director. Modules of the GREEN/GALAX were implemented simultaneously in core business functions. There also remain a number of file exchange operations whereby data is extracted from the GREEN/GALAX system and input into standalone applications for inventory management and product design. The director of the company wanted a quick implementation, so enough time was not allocated for training.
10	Did you identify required reports during the project, please explain? yes for all modules, company requested report
11	How was your data migration process? Did you have problems transferring data and receiving data? Software vendor migrated the data during implementation before running the system. It took so much time, as mostly was paper work.
12	Did you start the deployment from a specific department? Why? NO
13	Do you have any system owner to monitor and lead the system? What was his role, please explain? Yes for each module head of the department
14	What was the operating system? 2servers, Windows 2012 R2 on servers. on-premises operating system windows 10 R1: Commercial (8 PCs and 8 users), finacial (4 PCs and 4 users) , manufacturing (8 PCs and 7 users) , product design: (5 PCs and 5 users) , inventory (2 PCs and 1 users) and HR (0 PCs and 0 users)
15	What was the database platform? (Oracle, MY SQL) Microsoft SQL 2008
16	For your IS and/ or ERP solution what was your implementation timescale? Have you finished implementation according to your timescale? If yes what do you think was helping the process? If not what was the main issue that delayed

	the process? It was a Big bang implementation in 2014, Company choose Big bang , so the system goes live in next day
17	What was the overall cost of implementation? 150 million Toman equal to £30.000
Post- Implementation Phase	
18	Since you have done implementation have you had any upgrade or maintenance - please explain. NO, financial situation, also software provider did not offer any new version for the system yet. R1: Since 2014 that GREEN/GALAX has been implemented, company has not upgraded the system. Unfortunately, because vendor was located in another city, they did not support the maintenance. Therefore, company is using tired party consultant since March 2015. Furthermore, database administrator support and administrate modules. Also GREEN/ GALAX has not designed a new version of the ERP systems modules.
19	Are there any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area. No, but there is no secure back up. R1: the lack of satisfaction and high level of resistance to the ERP system from users caused some inaccuracy and duplications in data. those users that were not willing to use the system mostly caused data duplication or entered wrong data to the system Furthermore, inaccuracy in the inventory increased the imprecision in other processes due the integrated nature of the system.
20	Are you content with your current network architecture or are you looking for some further upgrades in the future? Please explain. We need a backup server. We have both wired and wireless internet. But budget is not available
21	Can data only be updated in one particular system or is there real time or batch updates between systems? Please explain. Any update in each system, will update other system as well. Also it does show who updated it.
22	Are there still any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area. Only in HR and inventory, because system are semi manual. Especially HR sometimes some file goes missing.
23	Does the current level of integration support the organisation's strategies? Please explain. yes R2: All department is content with its modules; however there is need for them to integrate the system with inventory. As they need to check the inventory list manual with sales orders. Also there is lack of training stop company to enjoy the benefit of the system R1: We have not measure GREEN/GALAX benefits and there is different viewpoint among the users regarding the benefits of the system.
24	What are the key business challenges in the company? (Duplication of files/documents, Duplication of efforts in generating a report, spent a lot of time in retrieving a document, No central contact database, Business processes are not integrated, Remote workers struggling to access company information Difficulty finding the latest and relevant documents on current system) Yes in HR we have many mistakes.

25	Have you customised any module? If so on which modules and why? No
Section end	

Section 3: People **This section will examine people skills and their readiness for change across the organization.**	
Pre- Implementation Phase	
1	What was the level of IT and computer literacy before ERP implementation? most employees had limited knowledge in using computer. R1: The lack of IT and computer literacy delayed the training of personnel who were to use the ERP modules, and increased the level of resistance to the new system within the users.
2	Did you have an IT department? How many IT staff did you have? Did you recruit new IT staff for new project? No, Just one Head of IT, and one database administrator
3	Did you identify main users and system champion before starting the project? What was your selection basis? No, R1: there was a lack of employee engagement throughout the whole implementation process. There was no standard way for selecting the key users , the assumption was that any employee would adapt to the new system independently with the training provided.
4	Did you set up the project team and project board before starting the project? If yes what was the impact of having them? No, software provider was responsible for whole project.
5	Do you think the main elements of the systems project were adequately explained prior to the start of implementation? No, many users did not know about new system till before implementation R1: Unfortunately, training was poor and insufficient and there have been significant user issues with some departments reverting to previous semi-manual processes. R2: Users did not clearly understand the new system and as such they were not satisfied and resisted using the new system. Therefore, in 2015 external consultants were engaged to review the status of the ERP project and specifically to provide training and user support. Users only trained for the modules they had been appointed to use. Training was poor and insufficient and there have been significant users' issues with some departments reverting to previous semi-manual processes.

	The training for each module consisted of three days. Therefore, the training was very short and condensed.
Implementation Phase	
6	What do think regarding management involvement? Was it supportive? Please explain how. NO, company managers they are not in contact with users.
7	Changes introduced in companies generally cause some kind of resistance from employees. Has your company faced any resistance from the introduction of an IS and/or ERP system? Please explain. Yes, most users used to resist learning or using new system especially old ones
8	Did you involve the main users in the whole change process? Did you explain the scope of the project to them? Did you communicate clearly with all users throughout all processes? Please explain. No
9	Did you have to change any employee's role? Or recruit new employees for the new system? Does the new system affect your employee job description and how? Yes only one database administrator.
10	What do you think regarding having a project manager during ERP project? R1: We did not have one, but I think will be useful. Software provider offer to provide a skilful project manage, but it was expensive. So company decided to use normal consultant for implementation. R2: We did not have one, but I think will be useful.
11	How many users were there for each module? 4 for finance, 8 for commercial, 2 in stock control, 8 in production
12	Who was on the implementation team? Did you use third party contractors? Database administrator, IT officer and software provider consultants.
Post- Implementation Phase	
13	Have you assessed user satisfaction and how? No R1, 2: there was no training program after implementation finished.
14	Do you provide regular training in case of upgrade or changes? R1: NO, I believe the company needed to provide some further insights through the system for users; however, the company felt constrained by budget R2: No, we had not any after implementation
15	Do you provide training for new users? Not specific training, but current users will train them

16	Do you think the employees are now comfortable using new systems and associating changes in processes and procedures? Have they adapted well to this change? Not at the first, but they are better now.
17	What do you think regarding the difficulty level of system support (including maintenance and upgrades) at the post implementation stage in your company? Please explain. We have data base administrator who is supporting maintenance. As the software provider is not located in Isfahan, we using third party consultant. And also it is useful if IT officer was fulltime.
Section end	

Section 4: Processes	
Pre- Implementation Phase	
1	How effective were your main business processes as identified in section 1? Finance and commercial and manufacturing are integrated very well and increased performance in those 2 department. R1: in 2013 we decided to automate some of its core processes, and this was embodied in its business plan, especially in finance and production planning. we were planning to change their processes in manufacturing and finance. weexpected that automating their manufacturing would have a direct effect on delivery and distribution. Additionally, since we launched, company had not experienced any information system and all areas of ETS was processed by Microsoft packages and a range of spreadsheets . The development of new and existing products led us to set a new business plan in 2013. R2: I think the business processes were not changed hugely
2	Were they manual or automated? Please explain. Commercial, finance and manufacturing are automated, Product design has off the shelf design software. HR in manual and inventory is semi manual by using spreadsheet.
3	Were there any major inefficiency? Please explain. Yes in HR there is mess in absence, leaves. Data lost duplication.
4	Was there any documentation in place? NO
Implementation Phase	
5	Did you Have any documentation of your process during the implementation? If yes could you please explain one of your company's main business processes? How it does work? (E.g. Manufacturing) NO , but we can give a description of how the GREEN/GALAX helps the ETS deal with its customer.
6	Did they become standardise? Was there any standard way of doing the business processes? No
7	Did you have to change your processes because of the way the system works? All system used to be manual or semi manual, no they are automated.

Post- Implementation Phase	
8	Did you identify any process owner for each process? If yes please explain for what reason they have been selected? Head of each department.
9	Have you reviewed or modified existing process documentation for further adjustment? If yes please explain. No
10	Are the business processes now adequately support the ERP? Please explain. R1: Yes the performance improved.
11	Is there scope for further process reengineering? Please explain. No
Section end	

Section 5: Additional information
Please use this section to give any further information relevant to this research. An extra note: 1- R1: the report were parts of module processes, they could easily be activated when needed. For example, finance modules could generate reports on available sales invoices and the purchase invoices matched to a period, and sales margin reports. However, processes such as inventory or HR, which involve a series of spreadsheets or paperwork, can affect the accuracy of these reports. Any human errors on those two processes lead to inaccurate data transfer between other departments that can affect their performance. 2- R2: project team included directors and Head of IT and consultants from the software provider (vendor), and the whole team was responsible for package selection and overseeing financial resources. we established the project team to help in decision making throughout the project. 3-R1: Regular power cut and poor internet connection are the major issues in our company

ETS Interview

1- Who are your main suppliers? Isfahan Steel company
2- What are your main components? Alloy Steal with 45 cm thickness and 50cm diameter, Alloy Steal with 55 cm thickness and 50cm diameter, Alloy Steal with 27 cm thickness and 27/28cm diameter, Alloy Steel 1/7131 cm thickness and 30/40cm diameter- we need 1500 Ton annually
3- You mentioned you have six processes, could you please explain the sub- processes for each processes?

   Manufacturing: production planning and assembly, quality control,
   Inventory: stock control
   Finance: accounting, general ledger and assets
   HR: personnel management
   Product design: product design
   Commercial: customer management, supplier management

   R1: the module deployment was not planned very well for several reasons. For example, ETS did not give a clear picture of goals of the ERP project to users. This leads to uncertainly among the users of what was happening and how they needed to cope with changes.
4- You mentioned you have 2 servers, please indicated what they are for?
   ETS has 2 servers including Data base server and Software server. Windows 2012 R2 are installed on all the servers. Microsoft SQL 2008 installed on database server, and also database back up is scheduled on this server. GREEN/ GALAX modules also run run on web server.
5- Could you explain the level of access for system users?
   Single sign on technique, GREEN/ GALAX Total system with drop list that enable the user to choose which subsystem based on their department to login. Therefore all users have their own personalised login details with different accesses and privilege. Head of each department can grant other users with extra or less permission. The whole system is controlled, maintained, and upgraded by one Database administrator (DBA) can control the whole process among the users.

6- What was your package selection procedure? The formal decision made by the company director in conjunction with the Head of IT, heads of department and software provider.

R1: we send proposal for several vendor, few vendors selected, then selected vendors presented their software to the company director, Head of IT, and head of departments in 2014. The formal decision made by the company director in conjunction with Head of IT, the head of departments and software provider consultants. The choice of the main software system again influenced by the fact that it was available in the Parsi language and there was easy access to software support and technical advisors.

SPC Questionnaire

Informed Consent Form

Questionnaire brief:

The purpose of this questionnaire is to investigate and assess the level of information systems (IS) and/or enterprise resource planning (ERP) adoption at manufacturing small-medium sized enterprises (SMEs) in Iran. The information gained from this questionnaire will help the researcher to answer research questions that are part of her doctoral thesis at the University of Gloucestershire, UK. All references to individuals will be anonymised; the real names of individuals will not be used, neither in the thesis nor in any related work.

The questionnaire will take approximately 45 minutes to complete.

Many thanks for your assistance.

If you have any queries or questions regarding this questionnaire please do not hesitate to contact:

Maryam Rezaeian, University of Gloucestershire

Email:

Mobile:

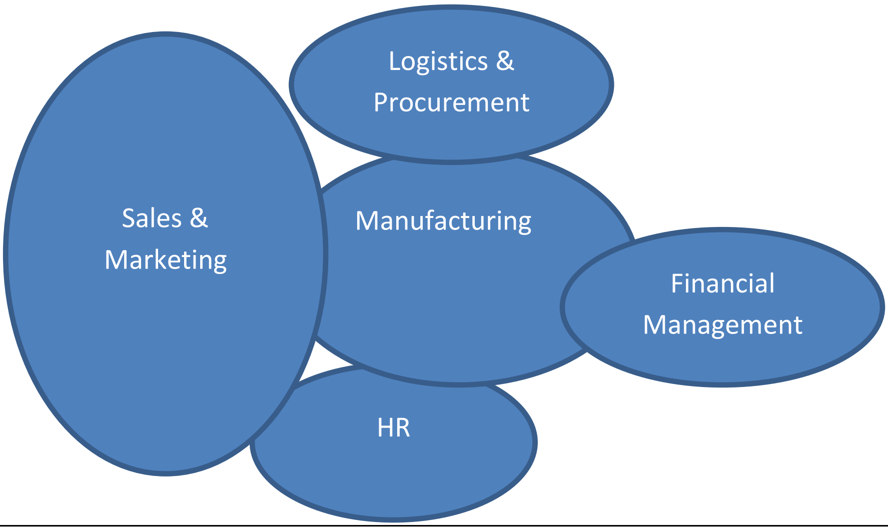
Participant Name and Signature:

Job Role in Company:

Date:

Section 1: General Company Information	
1	When was the company founded? family business Founded in 1995
2	Could you briefly state the company's core business? manufacture spare parts for commercial vehicles (trucks, buses, minibuses & vans)
3	What are the main departments in your company? (e.g. Sales & Marketing) Finance, Commercial (sales and marketing/ purchase and procurement), Human Resources, Manufacturing department.
4	Are you working at the company main site? Do you have other sites? Yes, they all working in main company, there is no other site for productions
5	Do you have staff that work remotely? (E.g. sales staff) No
6	In total how many employees do you have? And how many of them are working in your IT department? 250, 2 in IT R3: The IT office is located in the human resources department and consists of two full time IT staff, those being the IT manager and database administrator (DBA).
7	What is the present annual turnover of the company? N/A
8	Is the company profitable? Is it possible to mention how much profit you made last year? N/A
9	What are your company's main business objectives for the next 5 years? R1: increasing production line, and quality. Company aims to check and review products every two weeks either through physical test or visual inspections R 2: improve quality and reduce the cost. Company aims to check and review products every two weeks either through physical test or visual inspections R 3: improve quality and customer satisfaction. Customer service satisfaction and high quality standard in products is very important R 4: increasing production line and sales and marketing, reduce the costs. Customer service satisfaction and high quality standard in products is very important R 5: increasing production, improve the quality and customer service. Also in today's competitive market, poor quality of products leads to loss of customers and the essence of providing high quality standard and minimising manufacturing cost.
10	What are the objectives and plans for investment in information technology (IT) and information systems (IS) for the next 5 years? R1: upgrading the system and provide internal support for system , manufacture high quality products with less production cost, improve customer satisfaction and increase sales R2: provide support inside the company for using the system R3: increase the security, and employ more IT people

	R4: automate all processes, and upgrade the system R5: invest on IT employee and provide support inside the company
11	Do you think the investment in information technology is adequate to support the growth of the company and its objectives? If yes, please explain how? R1: Yes, company performance has been increased R2: yes, company performance increased and company save lots of time R3: yes, there is easy way to communicate with other departments, and duplication problem and risk of data loss as there was no back up plan in place.so we needed to consider investment. R4:yes, it is less manual data entering, save time and resources R5: yes, The core processes were not integrated and it was very difficult to get precise and reliable information from existing systems. As the company aims to develop and compete in the Iranian market, the need to integrate processes became prominent and led to the adoption of a more complete vision of different automated processes and the election of an IS solution.
12	Please provide some background/history regarding the use of computers, systems, networks and websites at the company. Manual system, 1 webserver, 28 desktop computers, 47 users Wifi connection for internet. , windows 7 was operating system and MS office. Hamkaran system from 2010, cost around 200 million Taman R3: 5 Pcs and 7 users in finance, 6 Pcs and 8 users in Sales and marketing, 10 Pcs and 20 users in Production and shop floor, 2 Pcs and 5 users in HR, and 5 Pcs and 7 users in Procurement and logistics. Previous processes used a series of spreadsheets, and MS office. They did not have consistent and accurate reports New system: has 4 server, 7 Pcs and 7 users in finance, 8 Pcs and 8 users in Sales and marketing, 20 Pcs and 20 users in manufacturing and operation , 5 Pcs and 5 users in HR, training 3 Pcs and 3 users, and 5 Pcs and 7 users in Procurement and logistics.
13	The diagram below provides a possible view of the main business processes in your company. A business process may be seen as a set of activities that cut across the functional and physical divisions of the company. Please make any comments on this top-level process map. Does it adequately represent what goes on in the company? Please add, change or delete?

	
14	Does the company use email both internally and externally? Please comment: yes, both internal and external
15	Does the company have a website, and what is it used for in general terms? Yes, it is for providing information
16	Does the company have its own intranet for internal use by its own staff? Please comment: yes, all staffs they use it for sending and receiving emails
17	Is mobile technology (laptops, iPad, iPhone) used within the company both internally and externally to send and receive emails or for data recording in the field? Please comment: No, users have their own personal, but there are some laptops and several iPad for meeting use.
18	How many personal computers, laptops and servers are used in the company? Are they linked by networks (either hard-wired or WIFI)? What systems run on the servers? Please comment: 50 computers, 3 laptops and 4 servers with cable or Wi-Fi

The following sections focus on the ERP/ Total system project based on three dimension of change (Technology, People, and Process). Each section has three phases including pre-implementation phase, implementation phase, and post- implementation phase.

The pre implementation phase questions focuses on company status before start of the project from different dimension of change.

The implementation phase focuses on the actual implementation process considering variety of change elements.

The post- implementation phase focuses on the status of RRP project after implementation to understand the level of project success.

Section 2: Technology **This section covers communications, hardware, and e-business aspects to understand the company's level of technology adoption.**	
Pre- Implementation Phase	
1	What systems and hardware did you have before the ERP implementation? Were they integrated or standalone systems? It was mainly MS office, Excel all been stand alone.
2	How good were they? Did they support business process adequately? No, business start growing and we needed automated system
3	Were all system manual or did they have some computerised? Semi manual, mostly Microsoft office.
4	Were there any problems with data accuracy, consistency and integrity within the organisation? (If so, please state in which area) Yes, interring wrong data by users, data duplication interring by different users, inefficiency of users by entering wrong data.
5	Were there any issues concerning the multiple maintenance of key corporate information? For example was customer data or product data updated in more than one system? No, if we needed to update, we needed to update in one system, and ask other users for update.
6	Could data only be updated in one particular system or was there real time or batch updates between systems? No.
7	How was your data conversion process for the ERP project? Did you have problems transferring data and receiving data? Company requested use to identify our data and manage them in excel spreadsheet and then they imported data during implementation. R3: conversion was guided by the software provider. It was a planned process. Firstly, we identified the required data and converted them into to the format software provider requested them. The project team was responsible for data conversion to reduce inaccuracy. It is useful to identify and validate the data before importing data to the new system, because efficient and validated data facilitates data migration and the whole implementation process.
8	Did you have any customisation on the system, if yes when was this done and were code changes required? Did you have bespoke requirements that the software provider had to prepare specially? No R3: that there was no need for customisation and HAMKARAN modules were able to execute and support the business processes.
Implementation Phase	
9	Which modules did you implement? Why? Did you have any plan on how to implement them? Did you have any issues? Sales and marketing, procurement and Logistics, Manufacturing, Financial, HR

	Company sales increased so we needed to automate the processes to make it faster to cope with demands by increasing production. Module by module implementation. All modules implemented at the same time. It took 2 years.
10	Did you identify required reports during the project, please explain? NO, because all moulders had capability to generate reports.
11	How was your data migration process? Did you have problems transferring data and receiving data? Software vendor converted the data and during implementation they migrated the data. We only had 1 source of data which we categorise them based on vendor guide line.
12	Did you start the deployment from a specific department? Why? No
13	Do you have any system owner to monitor and lead the system? What was his role, please explain? yes, head of each department responsible. IT and database administrator monitor whole system.
14	What is the operating system? 5 servers with operating system Windows 4 servers with operating system Windows 2012 R2 on-premises
15	What is the database platform? (Oracle, MY SQL) Microsoft SQL Server 2008
16	For your IS and/ or ERP solution what was your implementation timescale? Have you finished implementation according to your timescale? If yes what do you think was helping the process? If not what was the main issue that delayed the process? Yes, Took 2 years, gradually implement the system. R3: we selected phased implementation to allow employees to adapt gradually to changes in their system and ways of working.
17	What was the overall cost of implementation? software only £ 40000
Post- Implementation Phase	
18	Since you have done implementation have you had any upgrade or maintenance - please explain. No, finance problem
19	Are there any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area. No
20	Are you content with your current network architecture or are you looking for some further upgrades in the future? Please explain. no need for upgrade R3: we have no plan to upgrade the system due to current financial constraints and the limited budget for IT.
21	Can data only be updated in one particular system or is there real time or batch updates between systems? Please explain. Certain update can be done by users of each module, such as changing date; cost is not updatable by users. It is depend to the level of user's access.

22	Are there still any problems with data accuracy, consistency and integrity within the organisation? If so, please state in which area. No inaccurate data in new system is because the users entered the wrong information onto the system
23	Does the current level of integration support the organisation's strategies? Please explain. Yes all processes are integrated and it decreases the level of data interties, and inaccuracy.
24	What are the key business challenges in the company? (Duplication of files/documents, Duplication of efforts in generating a report, spent a lot of time in retrieving a document, No central contact database, Business processes are not integrated, Remote workers struggling to access company information Difficulty finding the latest and relevant documents on current system) Power cut in the main problem. We are planning to buy UPS (un-interruptible power supply), but we need the budget.
25	Have you customised any module? If so on which modules and why? No
Section end	

Section 3: People **This section will examine people skills and their readiness for change across the organization.**	
Pre- Implementation Phase	
1	What was the level of IT and computer literacy before ERP implementation? R3: We did not have any IT manager; company had a part time IT admin. For new system we advertise for IT manager and database administrator. Most users have a good in using computers R1, 2, 4, 5: we have one IT manager and database administrator.
2	Did you have an IT department? How many IT staff did you have? Did you recruit new IT staff for new project? No, 1 part time admin. We needed to recruit an IT manager and one database administrator. IT manager have BA in computer science and have a good knowledge of Oracle and SQL database as well as C++ and JAVA. Database administrator is also qualified in computer science and experienced in programing language and analysing systems. R5:

3	Did you identify main users and system champion before starting the project? What was your selection basis? only main users selected based on their previous job R3: selected users been skilful and confident
4	Did you set up the project team and project board before starting the project? If yes what was the impact of having them? yes project team including company key users, and consultant from software provider. Also having a project team helped us to identify modules which support operational needs.
5	Do you think the main elements of the systems project were adequately explained prior to the start of implementation? Yes R3, 4, 5: we requested full training to encourage users. However, individual users were trained only on the modules they needed to use. Training started with system owners (heads of department) and then training was scheduled for key users. After implementation, the vendor offered a limited period of on-site support for training. Since then, key users have been responsible to training the new users.
Implementation Phase	
6	What do think regarding management involvement? Was it supportive? Please explain how. Yes, their support decrease the users resistance
7	Changes introduced in companies generally cause some kind of resistance from employees. Has your company faced any resistance from the introduction of an IS and/or ERP system? Please explain. Not all the users, old users especially men used to resist learning or using new system.
8	Did you involve the main users in the whole change process? Did you explain the scope of the project to them? Did you communicate clearly with all users throughout all processes? Please explain. Yes each department had meetings every couple of months before starting implementation with main users to explain changes. R3: I and database administrator had regular meetings with head of departments and company director to check and report the implementation progress. The training was planned stage by stage. The initial training targeted only head of departments as system owners who were familiar with their respective department processes. Next stage was to train key users who had sufficient knowledge and IT skills. Last stage targeted the rest of main users. The training for each department focused on its respective module and how to use the system to complete a task. During the final adjustment, all users have been trained on various modules of the system. The training programme was in both face to face and also e-learning, also further training was arranged for new users.
9	Did you have to change any employee's role? Or recruit new employees for the new system? Does the new system affect your employee job description and how?

	No, just recruit some new one such IT manager and database admin.
10	What do you think regarding having a project manager during ERP project? Our IT manager was responsible for ERP project too, it was good as he was inside the company and understands the company better. Also software provider they had their won project manager.
11	How many users were there for each module? Sales and marketing: 8, procurement and logistics: 15, manufacturing: 20, financial 7, personnel management: 8, Each user has 1 computer.
12	Who was on the implementation team? Did you use third party contractors? Head of each department, main users, software provider implementation team including their project manager.
Post- Implementation Phase	
13	Have you assessed user satisfaction and how? No, users fit themselves and using it on daily basis
14	Do you provide regular training in case of upgrade or changes? Yes, yes during implementation
15	Do you provide training for new users? We try to use our own staff to save money.
16	Do you think the employees are now comfortable using new systems and associating changes in processes and procedures? Have they adapted well to this change? Yes, older users especially men found it difficult at the start.
17	What do you think regarding the difficulty level of system support (including maintenance and upgrades) at the post implementation stage in your company? Please explain. Because software vendor located in the same area as company, maintenance was not any problem, also data base administrator is always supporting maintenance.
Section end	

Section 4: Processes	
Pre- Implementation Phase	
1	How effective were your main business processes as identified in section 1? R 1, 4, 5: We are very happy with new system; system helped us for production, inventory, and process for personnel information is saved lots of time for company. The production and sales are increased and they are faster.

	R2: mostly used the way each department worked and then decided how each department should work, then chose the processes. R3: the performance is better and more accurate; the company financial is still lagging behind due the tight competition and also inflammation in country.
2	Were they manual or automated? Please explain. All processes are automated; however the training, (Part of HR) is manual. And maintenance and engineering is with Microsoft Excel.
3	Were there any major inefficiency? Please explain No system work very well.
4	Was there any documentation in place? No
Implementation Phase	
5	Did you Have any documentation of your process during the implementation? If yes could you please explain one of your company's main business processes? How it does work? (E.g. Manufacturing) No but they explained (please see chapter 6)
6	Did they become standardise? Was there any standard way of doing the business processes? It is a routine we follow, it is just important that we follow the system.
7	Did you have to change your processes because of the way the system works? No, only the processes are automated
Post- Implementation Phase	
8	Did you identify any process owner for each process? If yes please explain for what reason they have been selected? Head of each department
9	Have you reviewed or modified existing process documentation for further adjustment? If yes please explain. No this is expensive and time consuming.
10	Are the business processes now adequately support the ERP? Please explain. Yes. We manage to deliver our orders on time to all customers.
11	Is there scope for further process reengineering? Please explain. No, system and processes works fine
Section end	

Section 5: Additional information
Please use this section to give any further information relevant to this research. Extera Note: R3: perior to current system had no control over its information reporting. Providing reports was time consuming for users, and it was not accurate all the time. Implementing HAMKARAN modules give us a capability to generate reports for all modules in real time.

For example, this helped us to access consistent reports on sales and finance; however, only directors and heads of department had the privilege of generating reports

SPC Interview

1- Who are your main customers? Public Transport and Urban Traffic of the Country's Transportation and Terminals Organization, Maintenance garages and individuals.

2- You mentioned you have five processes, could you please explain the sub- processes for each processes?

   Manufacturing: production planning and production, quality control, engineering and maintenance
   Procurement and Logistics: inventory and distribution
   Finance: finance and accounting
   HR: personnel management, training
   Sales: sales and marketing

R3: modules were installed simultaneously in 2011 on a few desktop computers and the database server, and some key users were trained in the use of system. Systems modules were then installed on other desktops and users trained accordingly. Only then were some users put live, but this was done in a phased way and followed the order of the training programmes. The financial system users were first to use the new system, followed by manufacturing process users, sales and marketing, procurement and logistics and finally human resources users. Overall, this roll-out and move to 'go live' took four months in the period November 2011 to February 2012.

Phased 'go live' minimised the resistance of users as it prepared users for changes, giving them more time to understand the system and also helped the training process. Because all modules were implemented at the same vendor needed more consultants to be involved in implementation, which resulted in more costs for us. Furthermore, introducing system to process owner before to main users, helped the project team to address issues in the system and ensured a smooth transition to the new system.

3- You mentioned you have 4 servers, please indicated what they are for?
   R 1, 2, 3, 4, 5 : Four servers including database server, software server (Modules of HAMKARAN system), web and email server, and backup server. Windows 2012 R2 are installed on all servers. Oracle has been installed on the database server.

HAMKARAN modules have been installed on software server. The company Email and website are hosted on the webserver. Lastly, the backup server is used for archiving company data and the IT manager backs up the data from various servers on weekly basis.

R3: we needed to consider appropriate IT infrastructure to achieve project success ,so we needed to provide more servers and computers for new projects. As a result, these costs were added to the implementation cost. providing several servers added reliability to business.

4- Could you explain the level of access for system users?

R 1, 2, 3, 4, 5 : All users have their own specific privileges which determined by head of department. The privileges and accesses for head of departments are authorised by company director. If any users reach the maximum unsuccessful attempts log on, the session will automatically terminate and trigger block user.

5- Who were in your project team and project board?

R 1, 2, 3, 4, 5 Project team included selected managers from across all departments, main users and software implementation team including project manager. Project team was responsible for module selection and deployment, again emphasising the importance of having a competent project team. No project board

R3: understanding of the business needs and also design of the project plan, which documented its scope, and the timeline created by project team, helped us to distribute the goals of the ERP project to the users. Also having a project team helped us to identify modules which support operational needs.

6- What was your package selection procedure?

R1, 2, 4, 5: Head of IT shortlisted several products and requested work shop form each vendor. A committee of head of each department set up and attended the workshops. After reviewing all shortlisted packages committee selected HAMKARAN Total system. HAMKARAN is Iranian Brand; the preference was again like other cases based on languages (using Parsi), and also easy access to company for repair or upgrade.

R3: I shortlisted several products and requested work shop form each vendor. A committee of head of each department set up and attended the workshops. After reviewing all shortlisted packages committee selected HAMKARAN Total system. HAMKARAN is Iranian Brand; the preference was again like other cases based on languages (using Parsi), and also easy access to company for repair or upgrade.

7- did you experience any technical issues?

R3: Regular power cuts were the main issue in SPC; but we overcame this issue by providing an Uninterruptable Power Supply (UPS)

Appendix 2

IBC BOM for a Midi- Bus

	Part NO.	English Name	Quantity
1	5010-11-00084	Air intake box	2
2	5010-20-00104	Upper air intake box	2
3	5102-01-00010	Mudguard rubber fix plate	8
4	B0200030.00100	Connect steel plate	12
5	5010-11-00329	Air intake duct	2
6	B0300080.00711	Steel plate	2
7	0000-10-02823	Power steering oil can	2
8	0000-10-02995	Hook nut	2
9	0000-10-03213	Expansion tank bracket	2
10	5101-01-19744	Electrophoresis pry brackets	8
11	0000-01-01400	Radiator bracket connect part	2
12	0000-01-00883	Auto fire extinguisher bracket	4
13	0000-11-00960	Angle steel	2
14	B0100030.00100	Inner lable plate	14
15	9901-10-00023	Cable holder	160
16	1602-01-00408	Base plate	2
17	5960-01-01025	Holder with hole	4
18	6100-01-00135	Door pump space limit stiffener	2
19	5302-01-00197	Before the fog lamp holder	4
20	5302-01-00196	Before the fog lamp holder	4
21	ZJ011012020.01800	Angle steel	12
22	ZJL005009060.01200	Aluminum angle steel	6
23	LA0100070.01200	Aluminum plate	6
24	ZC050052045.00190	Channel steel beam	20
25	5931-01-06633	Bottom connect plate-welding	2
26	5101-11-23071	Guider seat angle steel	2
27	5102-01-02640	Right front wheel front mudguard	2
28	5101-11-25986	Right front wheel front mudguard	2
29	5960-01-01385	Hinge holder	4
30	0000-01-00048	Horn bracket	2
31	5602-00-00181	righe upper sealing plate support channel	2
32	5101-11-23070	Right front wheel side mudguard	2
33	5900-01-01376	Right rabbet	2
34	5960-01-00480	Right rear door frame	2
35	5900-01-01375	Left rabbet	2
36	5960-01-00479	Left rear door frame	2
37	5101-01-05846	Seal channel steel	2
38	5101-01-19953	Seal channel steel	4
39	5101-01-05844	Seal channel steel-bottom welding	4
40	5102-11-00321	Rear wheel front mudguard	4
41	5101-11-23069	Left front wheel side mudguard	2
42	5101-11-09794	Driver area right seal plate	2
43	5102-11-00262	Left front wheel front mudguard	2
44	5901-01-06691	Left rear column seal plate	2
45	5931-01-07649	Inner adjust plate	2
46	5901-01-06690	Right rear column seal plate	2
47	5101-11-02076	Stair middle guard plate	2
48	5102-11-00320	Front wheel rear mudguard	4

49	5931-01-05675	Bottom connect plate-door install	2
50	5102-11-00322	Rear wheel rear mudguard	4
51	5401-01-03607	The driver small skin below the window	2
52	5401-01-03606	The driver skin below the window	2
53	5101-11-02393	Right front wheel upper mudguard	2
54	5931-01-07650	Bottom adjust plate	2
55	5901-01-04976	Middle seal plate	4
56	5101-01-06503	Channel steel beam	4
57	5101-01-01531	Channel steel beam	2
58	ZJ012575020.01230	Angle steel-sheet metal assemble	4
59	5901-01-07053	Left rear column seal plate	2
60	5901-01-07052	Right rear column seal plate	2
61	5901-01-07050	Left front column seal plate	2
62	5901-01-07049	Left front column seal plate	2
63	5931-01-05663	Heating cabin right guard plate	2
64	5931-01-05662	Heating cabin left guard plate	2
65	5980-11-01182	Right seal plate	2
66	5102-01-00503	Front sheet seal plate	2
67	5411-01-02581	Side seal angle steel	2
68	5901-01-07051	Right front column seal plate	2
69	3900-20-00017	Spare tyre rod	2
70	0000-11-04343	Driver area left baffle	2
71	0000-01-00005	Radiator adjust rod fix angle steel	4
72	4999-01-00553	Angle steel	2
73	4999-01-00554	Angle steel	2
74	5931-01-02328	Side seal plate(right mounted)	2
75	B0100120.00770	Steel plate	4
76	B0120070.00600	Steel plate	12
77	B0180050.00600	Steel plate	4
78	B0100160.00220	Steel plateB-1.0	2
79	B0100230.00230	Steel plate B-1.0	2
80	B0100160.00240	Steel plate	2
81	5960-01-02016	Wheel cover holder	16
82	0000-10-01625	Expansion tank fix part	2
83	5102-01-02427	Rear high floor left angle steel-front&rear sheet	2
84	5102-01-02428	Rear high floor right angle steel-front&rear sheet	2
85	6100-01-00003	Guide rod downside holder	2
86	G032200.00055	Steel pipe	4
87	5301-11-00592	Downside rabbet	2
88	5301-11-00594	Upper rabbet	2
89	0000-11-05260	Driver area right baffle	2
90	5900-01-00554	Stand bar downside holder	2
91	3700-11-00001	Magnetic valve holder	2
92	5915-01-00280	Right guard plate	2
93	5915-01-00279	Left guard palte	2
94	5402-01-00498	Left rear angle sheet	2
95	5402-01-00499	Right rear angle sheet	2
96	5401-01-10888	Left wide seal angle steel	2
97	5915-01-00281	Inner plate	2

98	5903-01-01619	Left column seal plate-cabin door assemble	2
99	5960-01-01179	Downside rabbet 490*2120	2
100	5960-01-01178	Downside rabbet 640*2120	2
101	5903-01-01621	Inner plate	2
102	5931-01-05664	Heating cabin inner plate	2
103	5101-11-07726	Stair front guard plate	2
104	5903-01-01620	Right column seal plate-cabin door assemble	2
105	5102-01-02351	Front seal angle steel	2
106	5401-01-11147	Driver window downside angle steel	2
107	5302-01-00206-4	Front outer vertical sheet	4
108	5301-11-00693	Right rabbet	2
109	5301-11-00694	Left rabbet	2
110	5401-11-02846	Emergency door upper outer sheet	2
111	5931-10-01266	Inner plate	2
112	5401-10-04009	Left floor angle steel	2
113	5411-01-05277	Right floor angle steel	2
114	5960-01-01285	Door frame	6
115	5960-01-01286	Door frame	6
116	5960-01-01287	Door frame	8
117	5960-01-01382	Door frame	2
118	ZJ012575020.01194	Angle steel	2
119	5101-11-23072	Right front wheel upper mudguard	2
120	5102-01-02432	Right seal aluminum plate-left roof air intake	2
121	5102-01-02431	Left seal aluminum plate-left roof air intake	2
122	ZJ010100030.00505	Angle steel	2
123	ZJ010105090.00620	Angle steel	2
124	B0600060.00647	Steel plate-bottom welding	4
125	B0600060.00493	Steel plate	4
126	5101-10-15873	Side beam-skeleton welding	2
127	5101-10-15872	Side beam-skeleton welding	2
128	B0500040.00050	Steel plate	10
129	B0500040.00040	Steel plate	16
130	B0500030.00040	Steel plate	16
131	B0200060.00060	Washer	6
132	DS0500074.00038	Tringle plate	16
133	B0500010.00270	Steel plate	20
134	3900-20-00001	Fork	2
135	3703-20-00002	Double floor battery tray	2
136	ZC020023011.00025	Channel steel	24
137	3600-01-00050	Gourd block	6
138	5601-01-00776	Rear sheet left stiffener	2
139	0000-10-02631	Left rear extension part	2
140	ZJ010050030.00650	Angle steel	2
141	B0500090.00190	Steel plate	2
142	ZJ010130025.00515	Angle steel	2
143	ZC020040020.00110	Channel steel-bottom steel	6
144	5601-01-00777	Rear sheet right stiffener	2
145	B0500050.00200	Steel plate	2
146	ZJ017025025.00704	Angle steel	2
147	ZJ012015015.00735	Angle steel	4

148	B0500050.00240	Steel plate	2
149	ZJ010075030.00530	Angle steel	4
150	ZJ050040020.00200	Connect angle steel	24
151	5101-10-13582	Rear section steel corner-bottom welding	4
152	5101-11-22415	L type steel component	4
153	3700-11-00002	Junction fix channel steel	2
154	5101-10-28898	Guider seat holder	2
155	ZC012070020.00671	Channel steel	4
156	ZJ010040040.00770	Angle steel	2
157	ZJ010040040.00920	Angle steel	4
158	ZJ050060020.01236	Angle steel-bottom welding	6
159	ZJ050060020.01200	Angle steel	4
160	ZJ050060020.01316	Angle steel	4
161	5101-10-04306	Gear box service port frame-bottom welding	2
162	ZJ010020215.00700	Angle steel	2
163	0000-20-01322	Hanging bracket	2
164	5903-01-01611	Base plate-welding	2
165	5401-01-1559		2
166	5931-01-05665	Heating cabin base plate	2
167	5931-01-07651	Roof panel	2
168	5302-10-00196		2
169	5101-10-28899	Cross beam	2
170	5302-10-00204	Dashboard support part	2
171	ZJ010120040.02030	Angle steel-sheet metal assemble	2
172	ZJ010040040.02170	Angle steel-sheet metal assemble	2
173	ZJ010040040.02190	Angle steel-sheet metal assemble	2
174	ZJ050060020.00605	Angle steel	4
175	ZJ050060020.00671	Angle steel	4
176	5915-01-00297	Base plate	2
177	8140-20-00105	Heater bracket	2
178	ZJ010480200.02280	Angle steel	2
179	5102-01-02408	Rear high floor seal plate-sheet metal assemble	2
180	3700-21-00159	Cable holder	4
181	5604-01-00267	Hinge holder	4
182	5301-11-00597	Downside window angle steel	4
183	5960-01-00125	Bumper connection plate	4
184	9901-30-00001	Power switch bracket	2
185	5604-01-00082	Air support rod bracket	4
186	5602-01-00139	Terminal block channel steel	4
187	5604-01-00148	Lock bracket	2
188	5602-01-00199	Terminal block channel steel	16
189	5960-01-01177	Wheel cover holder	4
190	5960-01-02258	Wheel cover holding angle steel	16
191	5101-01-00550	Channel steel	8
192	5960-01-00040	Lock stop	20
193	ZJ015030015.02225	Air duct angle steel	12
194	5101-10-04307	Luggage compartment door	6
195	5101-10-32712	Parallel door holder	6
196	5602-10-00106	Rear bumper	2

197	5302-01-00216	Headlamps stents	2
198	5302-01-00217	Headlamps stents	2
199	5302-01-00218	Headlamps stents	2
200	5302-01-00219	Headlamps stents	2
201	6801-01-00004	Brake/accelerator bracket	2
202	5302-01-00206-1	Front roof sheet(with avaiation light frame)	2
203	5302-01-00206-5	Front downside sheet	2
204	5602-01-00127-1	After the top	2
205	5602-01-00127-2	Lamp box	4
206	5602-01-00127-3	Back around	4
207	5602-01-00127-4	Combination light tank	4
208	5602-01-00127-5	After the middle around	2
209	5101-10-19092	Driver area right side-bottom welding	12
210	5101-10-19097	Driver area skeleton-bottom steel	12
211		دریچه هواکش	2
212		ورق کوبی کف	2
213		ورق کوبی بدنه	2
214		ورق ساده بدنه	2
215		ورق رکاب	2
216		دوبل پوسته جلو	2
217		دوبل پشسته جلو	2
218		نبشی 30*30	5
219		نبشی تقویتی کف	12
220		نبشی تقویتی کف	16
221		نبشی کف	6
222		نبشی کف	4
223		ابرو	2
224		لبه سقف	8
225		نبشی 30*30 به طول 80 سانتیمتر	2
226		نبشی 20*30 به طول 2 متر	3
227		نبشی 10*30 به طول 2 متر	2
228		پروفیل 40*60 به طول 70 سانتیمتر	2
229		پروفیل 30*50 به طول 45 سانتیمتر	4
230		Five large	2
231	3801-10-00023	Instrument desk assembly	2
232	8140-01-02933	heating system	2
233	8140-01-02624	Defrost system assembly	2
234	ZJ050060020.00200	Angle steel	16
235	ZJ050040020.00120	Angle steel	16
236	5301-11-00596	Upper window angle steel	4
237	5X200X50	The steel plate	2
238	5X240X50	The steel plate	2
239	5X240X60	The steel plate	2
240	5X270X60	The steel plate	2
241	5X190X90	The steel plate	2
242	6X493X60	The steel plate	4
243	6X647X60	The steel plate	4
244	3X350X40	The steel plate	2
245	5604-01-00082	Terminal block channel steel	4
246	ZJ010030015.00240	Floor steel	4

247	ZJ010030015.00360	Floor angle steel	6
248	ZJ010030030.00790	Angle steel	2
249	ZC0180070020.00670	Angle steel	4
250	2X60X60	The steel plate	6
251	LA2X800X15	Aluminum plate	4
252	B0300040.00350	Steel plate	2
253	ZCL005160020.01200	Channel steel	4
254	LA0200015.00800	Passenger door seal plate pressing strip	4
255	ZCL005160020.01200	Channel steel	4
256	B0500060.00240	Steel plate	2
257	B0500060.00270	Steel plate	2
258	ZJ050060020.00200	Angle steel	4
259	5600-11-00083	U type part	4
260	B0100410.00500	Steel plate	2
261	5602-00-00182	left Upper sealing plate support channel	2
262	5101-01-19952	Seal channel steel	2
263	5140-01-02014	Stair rear guard plate	2
264	ZJL010025045.01800	Aluminum angle steel	2
265	3X711X80	The steel plate	2
266	5006-01-00024	Stick belt-left	2
267	5006-01-00025	Stick belt-right	2
268	2X100X30	The steel plate	12
269	3X450X40	The steel plate	4
270	0000-01-00007	Expansion tank clamp	4
271	5302-01-0123	A tail lamp holder	2
272	5302-01-0124	Tail lamp bracket 2	2
273	9901-10-00006	End ring	2
274	9901-10-00001	Service door cover plate	2
275	9901-10-00007	Floor cover bolt washer	16
276	B0150030.00030	Seal plate-bottom welding	16
277	LA0100070.01200	Aluminum plate	6
278	9901-12-00001	Fire extinguisher bracket	2
279	5704-10-00092	Compressed air intake cap-left air intake	2
280	5102-01-02393	Rear high floor seal plate-sheet metal assemble	2

Appendix 3

Average Scores for each Dimension over the Phases of Implementation

	Dimensions	Elements of change	IBC	ETS	SPC
Pre- Implementation					
	Average		3.4	3.2	4
		Appointment of project board, and project team	3	1	3
	Average		3.5	1	3.25
		Process and sub-process structure	4	1	4
		Process assessment	2	1	4
	Average		3	1	4

		ERP Modules deployment			
		Critical technology issues	4	2	4
	Average		4	1.5	4
		System users (system administrator, system champions	4	1	4
	Average		4	1	4
		Documentation	1	1	1
		Standardisation	1	1	1
		Process change	4	2	4
	Average		2	1.333333	2
	Average		2.5	1.5	2.5
		Follow up training in case of upgrade	4	1	4
	Average		4	1.5	4

		Process improvement	4	2	4
	Average		3.25	1.25	3.25

Summary of Averages

Implementation Phases	***Dimensions***	IBC	ETS	SPC
	Technology	3.2	3.4	4
	People	3.5	1	3.25
	Process	3	1	4
	Technology	4	1.5	4
	People	4	1	4
	Process	2	1.3	2
	Technology	2.5	1.5	2.5
	People	4	1.5	4
	Process	3.25	1.25	3.25

Appendix 4

Feed Back Request from IBC

After completing the model, the researcher shared it with the case study companies: only one responded with feedback, which was IBC.

From: [redacted]
To: "'Rezaeian, Maryam'" >
Subject: RE: requested feedback

Dear Maryam,

Your model seems very useful, as it help us to understand the success factors and avoid unnecessary points.
I think communication and training are focal points for us. The only concern is documentation, however I think is very useful, but this is expensive and time consuming process.

Best Regards,

IBC IT Manager
Mehdi
[redacted]