A framework to apply cloud-based enterprise resource planning in the United Arab Emirates manufacturing companies-a case approach

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Abstract

Enterprise Resource Planning (ERP) systems provide great benefits to companies. Companies in the Middle East realises that there is an urgent need for understanding ERP adoption and implementation issues since use of ERP systems are still in the early stages in these countries. Also, use of cloud ERP is very limited and there is no much empirical study has been carried out in this field. The purpose of studying this topic is to examine factors that influence the selection and adoption of cloud based ERP in UAE manufacturing companies. A comparative study was carried out in UK and UAE SMEs to evaluate the differences in the perception and application of cloud based ERP. Through empirical study and extensive statistical analysis, the technological and cultural barriers that impede the adaptation and implementation of cloud based ERP successfully in UAE manufacturing companies were recognised. Based on the critical success factors identified in the analysis, a cloud based manufacturing ERP model (CBMERP) with a specific focus on flexibility, scalability, faster deployment, access to advanced technologies and more ease of use was developed. Validation study of CBMERP revealed that UAE SMEs which experimented the proposed model achieved improvement in their manufacturing operations through shorter cycle times, reduced manufacturing costs, improved supply chain management practices and shorter delivery times. This research contributed to the existing body of knowledge by identifying that a significant gap exists in the factors that influence the success of an ERP system in manufacturing SMEs particularly in UAE. This study addressed this gap by providing a conceptual framework of the influential factors involved in the success of a cloud based manufacturing ERP model suited for UAE SMEs.

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CHAPTER 1
INTRODUCTION

1.0 Background

The last fifty years the organizations have seen tremendous growth in the Information technology field. Computers have developed to ever-increasing speeds, large memory and storage capacity and increased process power. World has witnessed super computers and mini-super computers, Unix and Sun workstations and servers, IBM and Apple and many more different types of laptop computers and personal computers. There are also many software such as databases, spreadsheets, word-processors and much highly supplicated and specialized application for sales, finance, human resources and customer service (Mell and Grance, 2011).

Initially, majority of these systems were dedicated to specific tasks such finance and accounting and human resource management. This situation did not offer much flexibility to handle variety of business functions. Manufacturing companies struggled to cope with complex data sharing and management (Banerjee et al., 2011). They tend to use many different types of computer systems and applications to deal with various functional activities which led to a painstaking mix-match of different computer technologies and applications. Eventually, due to the developments in increased power and capacity of computer systems, the requirement for simultaneous separate and individual application was minimized. This enabled a single system to manage and handle many applications simultaneously thereby reducing or eliminating the necessity for multiple systems. However, many enterprises especially manufacturing companies struggled with inability of their systems being incompatible with each other and suffered lack of effective integration (Al-Mashari and et al., 2003). Instead of changing or replacing their computer systems, companies tend to operate with their existing, less effective and obsolete systems which led to redundancy of data and hardware and inconsistencies of data from one system to another. It became very important for many organizations to combine variety of their business applications, hardware and data which led to the development of the Enterprise Resource Planning (ERP) system (Rabay et al., 2013).

As described by Mond and Wagener (2009), ERP system or software combines various departments and functional groups in an enterprise to a single computer system which can serve all those departments with their requirements, through effective integration. Finance and human resource management departments too benefits from ERP systems through easily sharing information and communicate with each other.

Stein (1999) agrees that the integrated approach in ERP system has a remarkable return-on-investment if companies install the software appropriately and correctly. Due to fierce completion among companies in today's dynamic and unstable business environment f organizations strive to become global. Typically, manufacturing companies are trying their best to be closer to their market and customer and deliver value-added products and services on shortest possible time than their competitors (Karchur, 2013). Manufacturing companies in the UAE realize that such success can only be achieved by integration of all the business processes of an organization. ERP is a strategic tool that can help a company to achieve completive advantage by integrating all business operations and optimizing the available resources (Garg, 2014).

According to Li (2011), to be successful in global business, manufacturing companies need much greater interaction between customers and company. This highlights that in order to manufacture customized and value added products and deliver in time to the customers, organizations are expected to be closely linked to both customers and suppliers (Mahara, 2013). To meet on-time delivery and shorter manufacturing lead time, manufacturers must have efficient planning and control system which enable an organized and effective planning of all the business processes and operations within the entire enterprise. ERP has the required capabilities to combine and synchronize the various manufacturing and business functions into streamlined business processes (Khan, 2011).

The implementation of an ERP system is a very difficult, time-consuming and costly task. It can take companies several years to install the system and can force the organization to alter the regular business activities and the payback time can be longer than expected. Implementing ERP is an arduous task. Case studies have reported that some companies despite having spent significant amount of capital and time, suffered poor outcome of results. Analytical study of Chauban et al., (2011) shows that many companies who spent large amount of money on ERP systems and implementation did not achieve the expected business improvement.

The modern manufacturing environment is characterised by intense international competition; rapid product innovation, turnover and obsolescence; increased use of automation; adoption of new materials; new manufacturing technologies; and significant organisational changes. According to Garg (2013) and Palaniswamy and Frak (2013), these changes to the manufacturing industry have created the following challenges that manufacturers need to address to sustain the following competitive advantages:

- Accurate prediction of market needs
- Reduce product costs by reducing manufacturing cost
- Reduce delivery time by reducing manufacturing lead time
- Improve quality and reliability
- Increase value added features
- Provide product variety and options
- Provide products with additional and accessory functions
- Provide customised products
- Provide customer support

According to Umble et al., (2003) and Singh (2006), these challenges can be translated into manufacturing system requirements as follows:

- Effective market survey
- Elimination of waste and non-value added activities
- Improving material flow
- Product enhancement through innovative materials and advanced technologies
- Improve flexibility and efficiency in the manufacturing process and systems
- Support production systems with software in the design, manufacturing, planning and purchase of materials (e.g. CAD, CAM, MRP and ERP)
- Improving communication with customers and after-sales services

Competitiveness is need for survival. Like many other developing economies, manufacturing companies in the Middle East are forced to compete on a variety of factors such as price, quality, value added activities, low-cost manufacture, and ease of manufacture, shorter lead time and on-time delivery. Producing high quality goods and services at a competitive price in the world economy is a challenge to any organization, particularly in developing countries such as UAE. To compete in the global market requires a combination of advanced manufacturing systems and business operations which has traditionally been scarce in most Arab manufacturing countries (Lee and Bradley (2004).

As stated by Kiadehi and Mohammadi (2012), together with the above mentioned changes constitute new challenges for manufacturing businesses in the UAE States. Generally, with manufacturers in the developing nations are severely affected by these changes. It is generally accepted that these changes in the manufacturing environment should be accompanied by fundamental changes in the way manufacturing businesses are run. To be able to cope with the new manufacturing environment, new systems are required to evaluate, derive and sustain high performance and achieve a competitive edge (Stratman and Roth, 2002).

ERP system is considered to be one of the efficient systems that can help manufacturing companies in the Middle East to compete in the global market by improving their business performance.

1.1 Aim and objectives

Aim

To develop a framework to apply a cloud based ERP system to optimise business processes in UAE manufacturing SMEs.

Objectives

- Study the concept of ERP systems and state of art through literature review and ascertain the benefits of applying cloud techniques within a manufacturing organization's business units to enhance performance.
- Research cloud ERP system through critically analysing the service and deployments models, and decision-making process used to opt for the most appropriate cloud techniques.
- Carryout an empirical study on cloud ERP systems used in UK and UAE manufacturing SMEs to evaluate problems, issues, and barriers associated with its implementation and manufacturing performance.
- Identify critical success factors for cloud based manufacturing ERP.
- Develop a conceptual cloud based manufacturing framework for SMEs in the UAE to enhance business performance and validate the model.

1.2 Research Questions

- How implementing cloud based ERP system will improve the UAE manufacturing SMEs' ability in managing information and manufacturing performance?
- What are the challenges in adopting cloud based manufacturing ERP system in UAE SMEs?
- What are the critical success factors to implement cloud based manufacturing ERP?

1.3 Overview of research methodology

In general, a research must be conducted with an approach which states that the nature of the problem will lead to the means of the solutions. Thus, it is necessary to analyse the problem in some depth prior to the selection of the most appropriate research methodology and subsequent method.

The following steps were followed in this research:

Step 1 Identify research gaps

Step 2 Carry out empirical analysis

Step 3 Develop a conceptual cloud based manufacturing ERP framework

Step 4 Validate the framework

Step 5 Write the thesis

1.4 Significance of the study

Although global competition is not new for manufacturing companies, it has now become more intense. SMEs are also involved in global competition. Even local firms are no longer isolated as big firms are increasingly looking to source components and services and manage distribution through local firms. Competition intensifies companies to involve measures to improve their whole business process with regard to cost, quality, lead time, process technology and innovation in products. Hence, need for low-cost manufacture, ease of manufacture, value-added services, shorter lead time and quicker delivery time have become essential targets of manufacturing companies worldwide. These milestones can only be achieved through effective strategic and operational approach by integrating all the business operations of different functional department within the entire organisation. Deployment of cloud-based ERP system is considered as the best solution provider for this dilemma.

Manufacturing companies in UAE realise that there is an urgent need for understanding ERP adoption and implementation issues. ERP systems are still in the early stages in these countries. A sound knowledge and understanding of the causes and factors that influence and affect the implementation of ERP is important in decision making when it comes to whether to implement ERP or not within a company.

Additionally, companies in these countries, face several challenges with issues related to economic, cultural and basic infrastructure. Implementation of ERP in a company can be affected by various reasons and factors which are not fully described or identified. This research intends to identify, analyse and investigate the motivational factors for ERP implementation in UAE manufacturing SMEs through empirical study. This study helped companies considering implementing ERP system with likely problems they may have to deal with.

Based on the empirical analysis, a framework to implement cloud based manufacturing (CBMEERP) systems that are more appropriate to UAE manufacturing SMEs with specific focus on flexible scalability, faster deployment, access to advanced technologies and more ease of use was developed. Critical success factors that are needed for successful exploitation of the CBMERP that fits the business culture of the UAE SMEs were identified and integrated in CBMERP with the existing ERP system. The CBMERP enabled SMEs to transfer deployment responsibility, reduce IT personnel, reduce implementation and support costs. The proposed framework has proved to support companies to gain competitive advantages and overcome the barriers that are weakening UAE manufacturing companies to cope with the technological ERP system.

The study investigated the technological and cultural barriers that impede the adaptation and implementation of CBMERP successfully in UAE manufacturing companies and explored the relevant training strategies and tools to implement CBMERP. The study also provided guidelines to UAE manufacturing firms considering to implement CBMERP system.

CHAPTER 2

LITERARUTRE REVIEW

2.0 Definition of ERP system

Enterprise resource planning systems (ERP) which is also known as enterprise systems (ES) evolved from material requirement planning (MRP) systems. ERP system provides a framework for integration and standardization of business processes. There are many definitions for ERP system. ERP systems commonly consists of a suite of software modules (Figure 2.1) that permits a company to automate and integrate most of the business functions (Davenport, 1998), by sharing common data and allow practices across the organisations to produce and access information in a real-time environment (Marewick and Labuschagne, 2006).

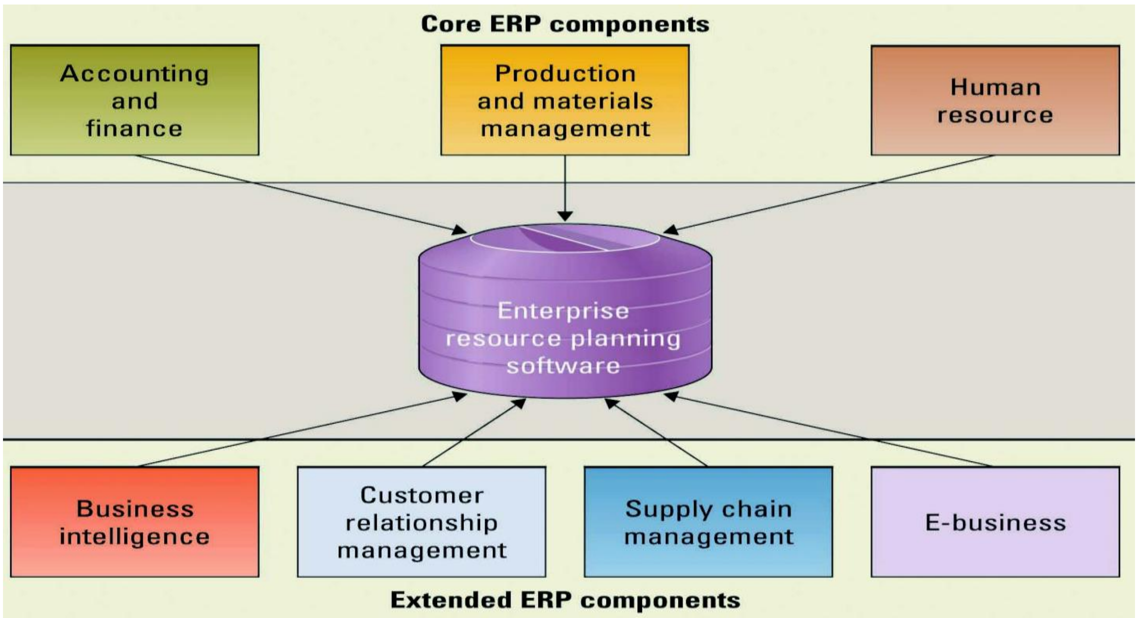


Figure 2.1 ERP components (Davenport 1993)

According to Davenport (1993), ERP system, at strategic level can be described as a packaged software system that enables organisations to effectively and efficiently manage and use their resources such as materials, human and finance. Gable (1998) defines ERP as a “comprehensive packaged software solution that seeks to integrate the complete range of business processes and functions in order to present a holistic view of the business from single information and IT architecture’. According to Watson and Schneider (1990), ERP system is an integrated packaged software-based system that handles the majority of an enterprise’s system requirements across all functional areas such finance, human resource, manufacturing, sales and marketing. Blackstone and Cox (2005) defines ERP as ‘framework for organising, defining and standardising the business processes necessary to effectively plan and control an organisation, so that organisation can use its internal knowledge to seek external advantage’.

EPP system modules are usually include financial and cost accounting, sales and distribution, material management, human resources and production planning. These tools enables to centralise recording of several business activities in a single database such as manufacturing, inventory management, sales, deliveries and billing. This arrangement eliminates the need for multiple entries of the same data (Jacobs and Bendoly 2003). Zahang and Li (2006) describe ERP as an integrated system because the application share a common database and transaction data can flow flawlessly from one module to the next without re-keying or software interfaces. Mabert et.at (2003) describe ERP system as organisation-wide on-line interactive system that supports inter-departmental and cross-functional processes using a common database.

2.1 History of ERP

In the 1960s, manufacturing companies focussed on inventory control to reduce the overall manufacturing cost. Evolution of just-in-time production system concepts was an example of this motivation (Saini et al., 2012). Later, in the 1970s, the concentration moved to material requirement planning (MRP I) systems, which translated the master schedule built for the end products into time-phased requirements for the subassemblies, components and raw materials planning and procurement. In 1980s MRP II evolved as an extension to MRP I (Koh et al., 2007). The concept of MRP II is to extent the control of management activities with additional control of companywide activities such as engineering, human resources, finance, logistics, project management and various other manufacturing functions i.e. a complete breath of operations and activities within the entire business enterprise (Koh and Saad, 2006).

As stated by O'Grady (2001), the term ERP was created to describe this expanded perspective. Many computer software packages were customized and designed to handle the inventory control systems. ERP was introduced in the early 1990s by the Gartner Group of Stamford (Jacobs and Whybark, 2000). Table 1.1 summarizes the evolution of ERP from 1960s to 1990s (Gupta 2000).

Table 2.1 History of ERP

Timeline	System	Description
1960s	Inventory Management and Control	Inventory management and control is the combination of information technology and business processes of maintaining the appropriate level of stock in a warehouse. The activities of inventory management include

		identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances and reporting inventory status.
1970s	Material Requirement Planning (MRP)	MRP utilizes software applications for scheduling production processes. It generates schedules for the operations and raw material purchases based on the production requirements of finished goods, the structure of the production system, the current inventories levels and the lot sizing procedure for each operation.
1980s	Manufacturing Requirements Planning (MRP II)	MRPII utilizes software applications for coordinating manufacturing processes, from product planning, parts purchasing, inventory control to product distribution.
1990s	Enterprise Resource Planning (ERP)	ERP uses multi-module application software for improving the performance of the internal business processes. ERP systems often integrates business activities across functional departments from product planning, parts purchasing, inventory control, product distribution, fulfilment, to order tracking. ERP

		software systems may include application modules for supporting marketing, finance, accounting and human resources.
2000s	Internet enabled ERP systems	Extended ERP system included: customer relationship management, supply chain management, advanced planning and scheduling, continuing ERP trends include capabilities for digitization, more mixed ERP options with cloud, internet of things, big data, mobile and analytics.

Gupta (2000) outlines the characteristics of ERP as follow:

- It is an integrated set of financial distribution and manufacturing software and an expanded and altered functional model of MRP II.
- It is a flexible application set that can reside on technology that can support it.
- It is proactive and it embeds business rules into software. It adapts to the rules of the business.

As argued by (Habbermann, 2000), ERP is not a revolutionary discovery but it is a result of the advancement of computerized system in business applications. In 1970, MRP II intrigued the use of advanced computer software to enable system's capability to manage material requirement planning. The new approach enabled manufacturing companies to exercise control over complex production processes and material management through the help of computer applications

(Finney and Corbett, 2007). When the philosophy of MRP II was introduced, manufacturing organisations viewed it as a disciplined and structured approach and a formal way to manage a manufacturing company. Adam and O' Doherty (2000) highlighted that ERP was dealing with making manufacturing decisions by taking into account, the impact on the supply chain system. In the same way as in MRP II, production decisions were affected by influence of major areas such as accounting, marketing and engineering (Karchur 2013).

In 1980's, the term MRP II was invented for new capabilities to be added in the MRP system. In 1990s, Gartner Group introduced the term ERP which comprised measures for assessing the extent that software was actually integrated both across and within the various functional storage system. Jacobs and Weston 2007) pointed out that 'ERP system had reached a level of maturity where both software vendors and users understood the technical, human resource and financial resources required for implementation and ongoing use'. Companies demanding quicker implementation cycles emphasised the project management issues in the ERP implementation.

2.2 How does ERP work

As shown in Figure 2.2 (Ganesh et al., 2014), ERP systems use the same database throughout the company to store different types of data for various computerized functions. ERP software integrates different business and operational functions into one complete system to streamline processes and information across the entire enterprise. Bemroider and Koch (2001) explained that the central aspect of all ERP systems is a shared database that supports multiple functions used by different business and functional unit. In the early days, ERP systems were mainly used for large manufacturing companies. Today, they benefit all sizes of companies including SMEs (Renganathan et al. 2011).

Figure 2.2 Key functions in ERP (Ganesh et al., (2014)

Key functions in ERP include:

2.2.1 Accounting and Finance

- General ledger
- Accounts payable
- Accounts receivable
- General journals
- Trial balance and financial reporting
- Bank reconciliation
- Cash management and forecasting
- Budgeting

2.2.2 Distribution

- Purchasing, tracking sales and
- shipments of inventory items
- Track by lot and/or serial numbers

- Track quality tests
- Warehouse management functions

2.2.3 Manufacturing

- Track the conversion of raw materials into finished goods
- Track labour, overhead and other manufacturing costs
- Provide the total cost of production

2.2.4 Service Management

- Track and monitor post sales service to products in the field
- Warranties
- Service contracts
- Product lifetime costing (costs related to development, introduction, growth, maturity) has become standard functionality in current ERP solutions

2.3 Benefits of ERP

The key benefits gained by implementing an ERP system include better control over costs, improvement on customer response times, streamlined and automated processes, visibility to data and process status. This integrated ERP packages are an alternative to difficult-to-maintain solutions developed by the information system (IS) departments which were only temporary solutions. These older systems were referred to as legacy systems. Legacy systems are operations that are used to process transactions. These systems are designed to perform specific tasks and operations. Majority of these older systems became obsolete and businesses needed major change and thereby required innovative software to improve business functions (Ji and Min, 2005).

ERP helps manufacturing companies to prevent duplicating various business and production functions. Case studies (Motwani et al., 2002) reported that organisations achieved better revenue through implementation of ERP systems through an organised control of information systems. Crowley (1998) reported that companies such as Compaq and Alcoa managed to reduce their inventory level significantly through implementation of ERP systems in their companies. These companies were also achieved shorter cycle times, reduced manufacturing costs, improved supply chain management practices and shorter delivery times.

As shown in Figure 2.3 (Davenport, 1990), ERP serves all the different departments and functional groups within a manufacturing organisation or enterprise by linking business operations and computer systems such as those used for accounting, manufacturing, sales, materials management, inventory, production systems, to facilitate and streamline thereby facilitating a smooth flow of information across the entire organization wide operations. Figure 2.4 shows the difference between the non-integrated and integrated system.

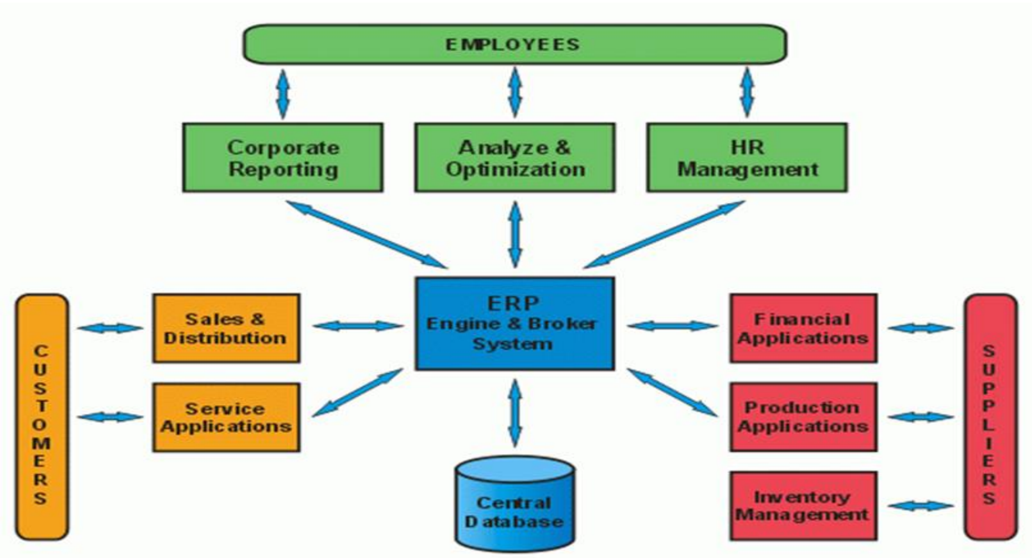


Figure 2.3 The full function of ERP consisting flow of work (Davenport, 1990)

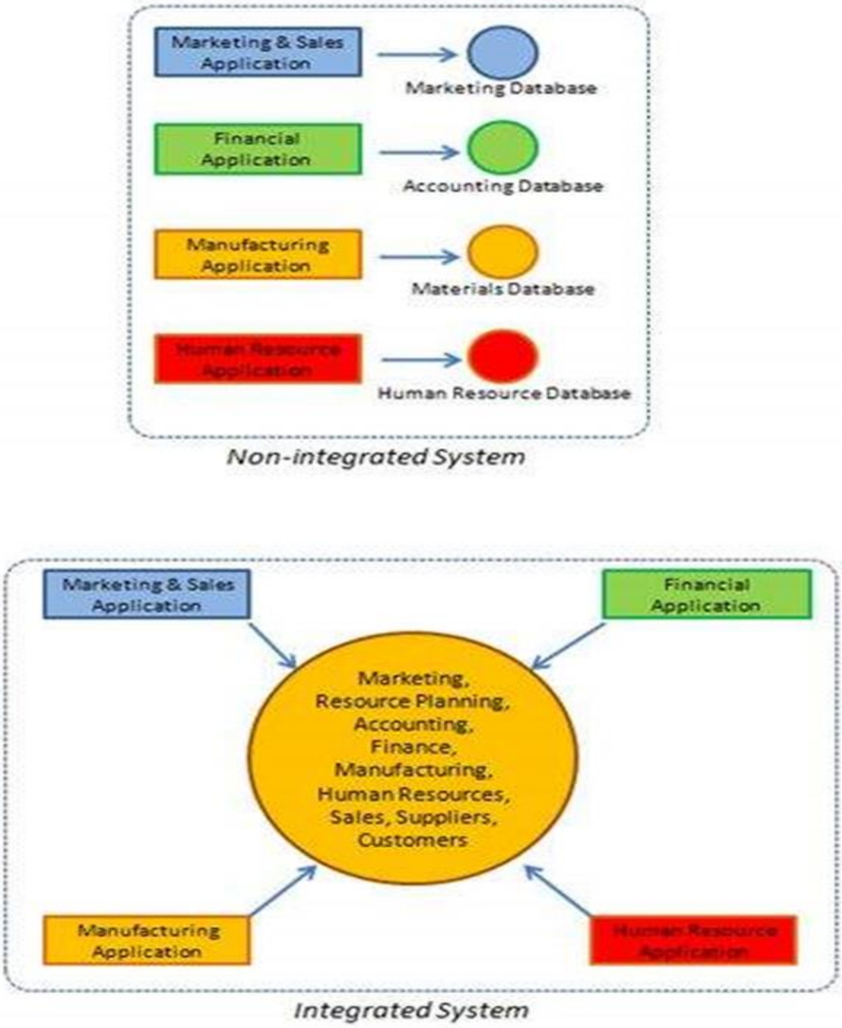


Figure 2.4 Non-integrated and integrated system
(Schniederjans and Yadav, 2013)

Scot and Vessey (2002) identified that ERP systems can smooth the progress of re-engineering business processes, worldwide operations, competitive agility and data integration across the enterprise. Technically, they can facilitate the setting up of more flexible and scalable architecture. Monk and Wagner (2009) emphasised that ERP implementation necessitates companies to increase their understanding of core business capabilities and make necessary changes to the way their business operates and existing operations that may otherwise have been ignored.

ERP systems can offer valuable benefits by integrating and automating all the business processes across the entire organisation. The benefits can be achieved at strategic and operational level simultaneously. However, it is imperative to implement ERP successfully to gain the maximum benefits. As highlighted by Shang and Seddon (2000), ERP benefits can be classified into the following five categories:

1. **Operational -** these benefits relate to reduction in cost and cycle time, improvement in customer service, quality improvement and manufacturing output.
2. **Managerial** – this relates to improved resource management, better decision making planning and performance management.
3. **Strategic** – relates to support for business development and growth, business innovations, building cost leaderships (it is strategy aims to exploit scale of production, producing highly standardized products, using advanced technology), generating product mix and differentiation and expanding external linkage. It describes a way to establish the competitive advantage.
4. **IT infrastructure** – benefits include building business flexibility, cost reduction in IT and increase in IT infrastructure flexibility.
5. **Organisational** - benefits include supporting organisational changes, facilitating business learning, empowering and building common visions.

2.4 Business success with ERP

Many researchers identified that companies that perform well in their business are those that are reactive to change (Peters and Waterman, 1982; Kanter, 1983). Since the beginning of 1980s, advances in information and communication technology (ICT) have accelerated the information flow and shortened the cycle of technological development. With ever-increasing customer expectations and rapidly changing business environments, there is an urgent requirement for today's manufacturing firms to be innovative to sustain competitive advantage in global competition. Due to such enormous pressure and coping with the changing business activities, many manufacturing companies worldwide have adopted ERP systems to sustain their business survival and existence (Bingi et al, 1999). According to Wallace (2001) "ERP as an organisation wide set of management tools that balances demand and supply that contains the ability to link suppliers and customers into a complete supply chain that employs proven business processes for decision making, that provides higher degree of cross functional integration, that provides foundation for e-commerce and enables people to run their business with high levels of customer service, high level of productivity, low level of cost and inventory" (Kiadehi and Mohammadi, 2012).

As identified by Davenport (1998), ERP is the most important development in the corporate use of IT in the 1990s and 2000s. Ehie and Madsen (2005) defined an ERP system as an integrated software solution that combines the range of different business processes that enables companies to gain a holistic view of the business enterprise. According to Koh and Saad (2006), "An ERP system allows the integration of functions, several divisions of businesses in terms of information exchange and flow, and the integration of business functions as diverse as accounting, finance, operations human resources, marketing, sales customer information and even the whole supply chain". The main goal of ERP is to link the market, distribution channel, operations process and supplier base effectively at low operational costs (Yusof and Aspinwall, 1999). Davenport (1998) explains that ERP and business process redesign are two very important tools that develops and improve organizational competitiveness.

ERP system provides a framework to integrate and standardize various business processes in an organisation. The benefits achieved by implementing an ERP system include improvements in control over costs, customer response times, streamlining business operation and automating processes, better visibility to data and status of process ERP system has been growing rapidly since 1990s. ERP systems offer great help to manufacturers in the supply chain management area. Through the integration of the upstream and downstream modules, the company will have much better and efficient capability to understand and manage their supply chains. Rashid et al (2002) identified that during the 1990s, ERP vendors added more modules and functions to the core modules. Examples of these new modules are advanced planning and scheduling (APS) and e-business solutions such as customer relationship management (CRM) and supply chain management (SCM).

2.5 ERP implementation in SMEs

Lately, many ERP system suppliers have increased their focus on SMEs. This has made manufacturing firms consider adopting ERP system due to the cost effective and competitive necessity to adopt the system (Upadhyay, 2013). Case studies (Markus and Tanis, 2000) claimed that SMES can benefit both strategically and technically by investing in ERP system. As identified by Markus and Tanis (2000), the business and technical reasons can motivate SMEs to implement ERP systems. The technical reasons involve the integration of various processes and applications, enhanced cross-functional working, reduction in software maintenance, eradication of multiple data entry, better IT architecture, reduced computer operational costs and elimination of difficult to maintain interfaces. Business reasons for motivating SMEs to adopt ERP system include business expansion, improvement in business processes, lower inventory cost and elimination of mistakes in customer order filling (Upadhyay et al., 2011).

2.6 ERP and manufacturing environment

According to Welti (1999), business managers in a manufacturing companies expect much from ERP. Manufacturing companies involves many processes such as order management, inventory, accounting, human resources, marketing, customer relationship management, delivery and more. At a basic level, manufacturing managers expect ERP to integrate all of these functions together to streamline processes and make information readily accessible throughout the organization.

There are a many ERP business applications that facilitate replenishment within the manufacturing sector. The four typical applications that support the buying and selling of product are: purchase order, sales order inventory management and material requirement planning (Palaniswamy and Frank, 2000).

2.6.1 Inventory management

Schniederjans and Yadav (2013) stated that for any manufacturing company which sells or manufactures products, inventory management system is a critical component of the ERP system. Upon receiving a purchased product, it requires to be updated in the inventory management system. The system should keep track of the current quantity continuously and value of inventory on-hand.

Because the inventory cost is nearly 40% for the overall manufacturing cost, companies always strive to maintain low level inventory, at the same maintaining a stock to satisfy the customer's demand. Manufacturing companies have to do this whilst maximizing the profit. Manufacturing companies must also maintain adequate level of safety stock to alleviate the risk of stock outs to meet the orders in a timely manner.

2.6.2 Purchase orders

The ERP purchase order system maintains track of order status, information of received goods etc. Purchase department sends order to a supplier to request raw material or a product. Upon receiving the purchase order from a customer, sales department makes an entry of the corresponding sales order to complete the customer's purchase request (Schniederjans and Rao 2000). When a company intends to order merchandise from their suppliers, a purchase order system provide information on type of product and history of previous purchases. Purchase order history provides firms accurate information about purchase date, price paid and delivery status. ERP helps the manufacturing company in material required planning by creating the Bill of Materials (BOM) which in turn facilitate ordering the type and quantity of raw materials or subassemblies needed for manufacturing the product in the timely manner (Stein 2000).

2.6.3 Sales orders

An internal sales order document is created as soon as a purchase order is received from the customer. The sales order details, the ordered product, quantity to be delivered, pricing, delivery date and other terms and special customer requests are generated. When the materials needed to manufacture the product are available, a sales order is converted into a work order generated. These documents provide direction to the shop floor regarding the product to make and materials required to make it. When product is ready to be shipped, a collection list directs which sales orders are to be completed based upon the order's ship date and customer priority. The ERP sales order system also considers shipping lead-time which is used to calculate the shipping date.

2.6.4 Materials requirement planning (MRP)

The MRP system in ERP helps manufacturing firms to plan and organize the type and quantity of raw materials and sub-assemblies needed for production and satisfy a customer order. MRP accurately calculate the purchase order based on various factors such as existing inventory level, open purchase orders, sales orders, work orders and forecasts. MRP systems assume that firms have an unlimited capacity to meet the production levels. Planning with an infinite capacity often leads to excess inventory (Ang et al., 2002). To cope with such uncertainties with a clever advanced planning and scheduling (APS) system becomes an essential component in MRP system. APS facilitates and handle a finite and constrained capacity planning. Bemroider and Koch (2001) agrees that without APS, manufacturing capacity and schedule may not match the inventory level and purchased materials. This situation may lead to excessive inventory levels due to materials being ordered to early. As highlighted by Davenport (1998), with all four of these basic components in ERP software, a manufacturing company can streamline their processes and use information more effectively throughout the organization. Modern ERP software continues to add and adopt new technologies, such as cloud, mobile, analytics, big data, and more to improve and become an even more efficient and effective tool for manufacturing businesses.

2.7 Market leaders in ERP

ERP solutions are very specialized field and the requirement of domain expertise is very important that solutions and their providers are categorised by sector. The major sectors of ERP Industry are:

- Manufacturing and distribution industry
- Communication
- Sanitary services
- Retail sector
- Transport
- Energy
- Service sector

There are five main providers in the ERP software market who control almost two thirds of the market. Copeland (1998) identified that SAP is the top ERP and other vendors include People, J.D. Edwards, Soft, Baan, and Oracle. Table 2.2 below lists the leading vendors in the market.

Table 2.2 Leading ERP vendors in the market

Providers	Solution
SAP	SAP is the top market leader in the ERP and is the third largest software company in the world. Its current version has more than 30,000 relational databases which enables to handle very complex business situations. At times, SAP can be too complicated and difficult to handle.
Oracle	Oracle was previously one of the best for its relational database. In 2004, Oracle started to devise its own ERP solutions. The first Oracle ERP product was Oracle Financial. Oracle became very strong in the ERP market and is now a well-established number two in the market.
Microsoft	Microsoft Dynamics provides solutions in many different business

	domains which includes Customer Relationship Management (CRM) domain. Microsoft products is very easy of use. It is also very popular for its ERP products.
Infor	Infor Global Solutions has grown rapidly since 2002. The company has clients in 194 countries. Infor provides solutions in 14 different domains
Epicor	Epicor started in1984, originally with DOS, Epicor later transferred its products to Windows and merged with ERP vendors for offer their solutions as a comprehensive package. Epicor has clients in more than 150 countries.
Lawson	Lawson provides customised solutions to SME business, The company has a presence in 68 countries and has more than top 10 ERP vendors. The company is known for its simplicity of the solution in a market known for its complexity.
QAD	QAD provides solutions designed to make it easy for first time ERP users. Their design solutions focus on minimising migration problems during the ERP implementation. The company work closely with its customers and gives continuous supports to ensure that their customers get their return on investment very soon.
Sage	Sage is a UK based company which was founded in 1981 and steadily grown into a big business. The company merged with DNA to ERP solutions.
IFS	IFS concentrate on building agile ERP solutions that use SOA architecture. This implies easy modification and adaptation to user needs. IFS is most useful four core strategic processes, service and asset management, manufacturing, supply chain and project

	management. It has a user base in excess of 2,000 installations and customers in 50 countries. One key reason for its success is its sharp focus on specific verticals (any software application that supports a specific business process and targets a smaller number of users with specific skill sets and job responsibilities within an organization).
Consona Corp	Consona is active in ERP, CRM, knowledge management and other related fields. The company is privately held and has grown by acquiring a number of specialist ERP companies. The company provides tailor made ERP solutions to manufacturing companies rather than a generic package.

2.8 Cloud computing technology

2.8.1 Definition

Mell and Grance (2011) defines cloud computing as a 'model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and release with minimal management effort'. Karchur (2013) defines it as a large collections of easily usable and accessible virtualised resources'. According to Onyegbula et al., (2011), cloud computing is an integration of computer resources and services that delivered by the cloud service providers to clients on-demand basis over the internet. Behrend et al., (2011) described cloud computing as an information technology concept where computing services are provided to clients using high performance network infrastructures and automated data centres. According to Ross and Vitale (2000), cloud computing is an ingenious technology which has caused huge impact in the way uses access and process ICTs.

Cloud computing is another form of computing that depends on sharing computing resources rather than using local servers or individual devices to manage applications. It is similar to grid computing, where unused processing cycles of all computers in a network are connected to solve problems that are too exhaustive for any stand-alone machine. Berman et al., (2012) describes cloud computing as ‘internet-based computing’ where different types of services such as servers, storage and applications are delivered to all the computers and devices in an organisation through the Internet. The objective of cloud computing is to apply high-performance computing power, usually used by research centres, military to perform tens of trillions of computations per second, in customer oriented applications such as financial portfolios to provide private information, data storage or to power large online computer games (Monk and Wagner (2009). To carry out these tasks, cloud computing uses networks of huge groups of servers usually running low-cost consumer PC equipment with specific connections to spread data processing tasks across them. This shared IT infrastructure comprises large collection of systems that are interconnected together. Usually, virtualization techniques are used to maximize the power of cloud computing (Onyegbula and et al., 2011).

2.8.2 ERP moving into cloud computing

Cloud computing has reshaped how information systems are operated and used. Lately, many users have started to use cloud based ERP solutions. Cloud based ERP systems cost much lower than the traditional ERP. Implementation cost of these systems cost less as much as 30% to 50% in comparison to ERP solution implemented on site (Berman et al, 2012).

2.9 Benefits of cloud ERP

2.9.1 Cost reduction

Durkee (2010) identifies that cloud ERP is more suitable for companies with many sites at geographically different regions. However, in the past larger organisations were more reluctant to experiment cloud solutions because of the complexity in the implementation of ERP. Smaller companies find this system more attractive because it is much easier for them to experiment with cloud solutions As highlighted by Rabay'a et al (2013) cloud-based ERP systems can offer many advantages than normal ERP systems implemented as a stand-alone-application within the organisation, computing environment, including increased scalability, system performance, cost saving through shared operations with lower cost.

Additionally, cloud computing provides manufacturing SME with wide range of new options for administering the ERP infrastructure. SMEs can enjoy benefits similar to large companies through the adoption of cloud services managing and maintaining the ERP. According to Yang (2012) and (Berman et al. (2012), cost reduction is one of the main reasons for the growing popularity of cloud computing among manufacturing companies. (Onyegbula et al (2011) identifies that companies aiming to reduce their operating costs are considering adopting cloud ERP as an alternative solution. Companies benefits the cost reduction because the cloud service providers take the responsibility of maintaining, managing, integrating and developing the infrastructures and application and hardware.

2.9.2 Scalability

Onyegbula et al (2011) explains that because there is a high level of elasticity in cloud computing, this allows consumer organization to scale up or down their services based on necessities and at the same time permitting the cloud service provider to distribute the services among their customers depending on their demands.

2.9.3 Reduced time to market

Cloud computing enables manufacturing organizations in getting their products to the market on time by making the businesses more agile, enabling the companies to adjust their processes, services, and products rapidly to meet fluctuating demands of the market and uncertainties in forecasts. Cloud computing also enable companies to optimise organisational resources by reducing the cost of monitoring and managing infrastructures. Besides, cloud ERP allows consumer organizations to have instant access to the latest technologies in the marketplace which is critical in reducing the lead time to market. Onyegbula et al. (2011) acknowledge that there are very minimal or no service outages in the cloud environment offered by the providers due to the fact that they are managed in a highly proficient manner and if there is any outage in services, they are resolved instantaneously.

2.9.4 Masked complexity

In ERP cloud, the upgrade and maintenance of hardware, applications and infrastructure are handled at the cloud service provider site and are hidden from the consumer organization (Bingi et al., 1999). Generally, the end users are not involved in maintaining the applications due to its complex nature. This allows end users to concentrate more on core responsibilities such as managing, maintaining and updating IT systems within their own companies.

2.9.5 Intercompany collaboration

Cloud computing technology inspires collaboration between organizations where they are able to leverage each other's IT capabilities to improve and innovate their business processes for increased productivity

2.10 ERP and cloud computing in UAE countries

As stated by Cliffe (1999) in the past manufacturing companies in the Middle East concentrated merely on managing the businesses rather than focusing on customer expectations. Lower awareness of consumer needs has reduced Arab manufacturing companies achieving significant success in the global market. To compete in the turbulent business market, manufacturing firms in the Middle East like UAE must improve the way they are doing the business by exploiting the new technologies and methods used in the developed countries like, UK, US, Germany and Japan. UAE companies have come to realisation and beginning to consider adopting the cloud based ERP systems in their businesses. However, the knowledge and understanding of ERP systems is still limited in Arab SMEs.

According to a survey report from Saudi Arabian Solution (1999), marketing ERP software in Saudi Arabia has always been very difficult due to the reluctance of the manufacturing managers who had little knowledge and understanding of ERP systems, the size, complexity and cost associated with implementation and training. Implementing ERP can be costly and time consuming. Like any other organisational change, it requires the top management's commitment and sustained effort from employees at all levels in the company. According to Saud Al- Sehali (2000), statistical findings from King Fahad University of Petroleum and Minerals showed that nearly 80% of large companies in the Kingdom were considering adopting ERP system in their businesses.

The Zamil Group of manufacturing companies, worth an asset of $200 million implemented ERP in their businesses. Saudi Arabian Solution (1999) also reported that manufacturing organisations in the country realises that about 55% to 70% of the total cost in a ERP project is the service and consulting costs. Bemroider and Koch (2001) identified that ERP often cost millions in terms of purchasing and implementing the system. Huge costs associated with ERP projects discouraged many companies from using consulting services in implementing ERP and carried out the task on their own or lower costs for a quick-fix solution. The end results were resulted in poor payback.

As identified by Huang and Palvia (2001) many manufacturing companies in developing countries still do business in the traditional way. Cloud computing provides opportunities for these companies to improve their business operations to compete in the world markets without the use of traditional infrastructure to facilitate trade. Cloud computing offers powerful computing systems at lower cost in comparison to the traditional infrastructure. For example, the cloud environment can enable manufacturing companies in developing countries such UAE to access data required for their research and development needs through telecommunications and computing infrastructures. Berman et al., (2012) acknowledge that likewise in the western world, mobile applications including mobile phones, users in the developed nations benefit from high speed personal computing. The Internet has made it possible for foster adoption of new technology. Clegg (2013) agrees that there are many mobile phone applications that have been deployed using the cloud-computing infrastructure with much easier access in developing countries.

ERP systems are best suited for manufacturing companies in UAE. They will facilitate cost saving solutions, improve efficiency and enable companies to sustain competitive advantage. Case studies show that many companies worldwide have implemented ERP systems and proved success by saving significant amount of money in operating costs, reduced processing times, manufacturing lead time and increased overall efficiency of their businesses

2.11 Challenges in cloud based ERP implementation in UAE companies

As indicated by Delozier (2013), ERP implementation is a very challenging and difficult task. Many firms failed due to lack of proper implementation strategy. Many problems and challenges will encounter during the ERP installation process. Chauban et al., (2013) suggested that many different critical issues must be considered to successfully implement the ERP system. According to them, examples include commitment from upper level management, reengineering of existing production processes and operational, integration of the ERP modules with other business information system, careful selection of ERP consultants, cost of implementation, implementation time, ERP vendors and selection of personnel. According to Bing et al., (1999), other critical factors include the training and morale of the selected employees. Understanding of the direct costs associated with ERP implementation and the payback period is another challenge in ERP. Case studies by Dezdar and Ainin (2011), Umble et al. (2013); (Fourney, 2007) and Chauban et al (2011) in ERP implementation in the developed countries have identified many challenges the affect the effective implementation and use of ERP systems. Some of these are listed below;

- Interconnection and integration problems
- Technological complexity

- Lack of proper ERP management
- Cost of technology
- Staff turnover
- Organisational change
- Product quality and vendor unreliability

2.12 Success factors for ERP implementation

Although there is growing popularity for cloud ERP, research in this field and its application in manufacturing business in developing countries such as UAE is still limited. Only limited research is evidence in ERP implementation mainly case studies in individual organisations have been published so far. Also there is not much empirical studies in ERP implementation in UAE manufacturing firms has been reported. Previous researchers, Truong (2010), Rabay et al., (2013) and Al-Mashari et al., (2003) agree that even though the IT has a great potential to promote economic growth in developing nations, the achievement depends on various factors such as local social and cultural issues, equipment availability, economic situation, IT infrastructure, availability of and personnel. The success of ERP implementation depends on many conditions and factors. Mabert et al., (2000) identified in his case study that many companies suffered failure in achieving maximum benefit in the ERP implementation projects. Hence, it paramount to identify the unique CFS that needs to be included in ERP model and implementation strategy.

CHAPTER 3
EMPIRICAL STUDY

3.0 Objectives of empirical study

Empirical research is carried out through someone's direct observation, experience or experiment. A research may not be considered as empirical if these fundamental principles are not followed. A research performed in this way should be able to answer the researchers own questions with corresponding evidence. The evidence or findings involved in empirical study can be either quantitative or qualitative. This means that the data gathered from experiments or observation can be interpreted either with a qualitative property or quantitative value (Black, 1999).

Any scientific research must be executed according to the basic principles of experience, observation and doing experimentations. Through a theory or hypothesis or a certain concern may be tested or experimented to arrive a conclusion with a result that is supported by dependable data or evidence. However, for scientific research to be accepted as realistic or accurate the activities involved in the survey must not rely on mere basic observation. Instead it should focus on testing a hypothesis through experimentations.

According to Creswell (1994), surveys are administered either at a point in time over a period of time with the sample population. In cross-sectional survey study, the aim is to define current practise or to appraise an activity in which the participants have been involved. There are mainly two instruments for researchers using survey method, namely interview and questionnaire. Interviews can be taken place in one-to-one settings. In a questionnaire method, participant is the one who records the data.

Collecting and analysing data from SMEs in UK and UAE were important for this research to understand and appraise their level of capability of managing IT, identify the barriers and critical success factors and evaluate the companies' level of readiness to implement the cloud based ERP system.

3.1 Types of surveys

3.1.1 Qualitative survey

As described by Demirbag et.al. (2006) qualitative research is used to discover, understand or describe a phenomenon that has been already recognized but not fully understood. This type of research involves gathering, analyzing and interpreting data that is very difficult to quantify and is established on meanings expressed through words. The tools that are used for qualitative research include observations and interviews. Interpretations is the methodological tool in this method. In this type of survey, theories are often 'supported' in data. Narrative methods are used in this research to assist in the interpretation and understanding of social interactions and phenomena.

3.1.2 Quantitative survey

According to Ang et al., (2002), quantitative survey approach is a variable-oriented approach which is theory based. Generality is given priority over complexity in this method because the researchers are mainly interested in testing propositions derived from general theories in this method. When a theory is tested, it is essential to gather a considerable amount of appropriate evidence and to apply analytic methods that are conservative by design. In this method, a study begins by stipulating the hypothesis to be tested and then outlining the widest possible population of related observations. Researchers study the relationship between variables and conclude a model of relationship or relationship (Alanis, 2011).

The aim of the survey was to identify companies' motivational factors for cloud based ERP, factors that impede the adoption of cloud based ERP, challenges SMEs face in implementing cloud ERP and CSFs for implementation. ERP should be fit to individual companies to work smoothly. It cannot be common for all types of manufacturing organizations. The interests and requirements of the organization and the ERP vendor should ensure that the system or modules fit the organisational needs. The concept of organizational fit is therefore considered important to the success of ERP systems in a diverse business environment (Kiadehi and Mohammadi, 2012).

The survey was carried out in manufacturing companies in UK and UAE where ERP system are already in place or companies planning to implement cloud ERP system in the near future. The survey instrument was designed to collect information on how UK and UAE SMEs differ in knowledge, application and practices in using ERP in their companies.

3.2.1 Objectives of survey in this research

The main purpose of the survey in this study is outlined below. This applies to both UK and UAE SMEs.

- To identify major influencing parameters for ERP cloud implementation.
- To identify the expected cloud services.
- To identify the challenges faced during cloud implementation.
- To identify the major tasks required to implement cloud based ERP.
- To identify strategic challenges in ERP cloud implementation.

- To identify various methods for resource implications.
- To compare UK and UAE ERP cloud operations.
- Identify appropriate critical success factors for cloud ERP implementation.
- To develop a mathematical model for ERP cloud implementation parameters using multiple regression analysis.

3.2 Research methodology

A block diagram of research methodology for ERP cloud implementation success in UK and UAE Manufacturing SMEs shown in Figure 3.1.

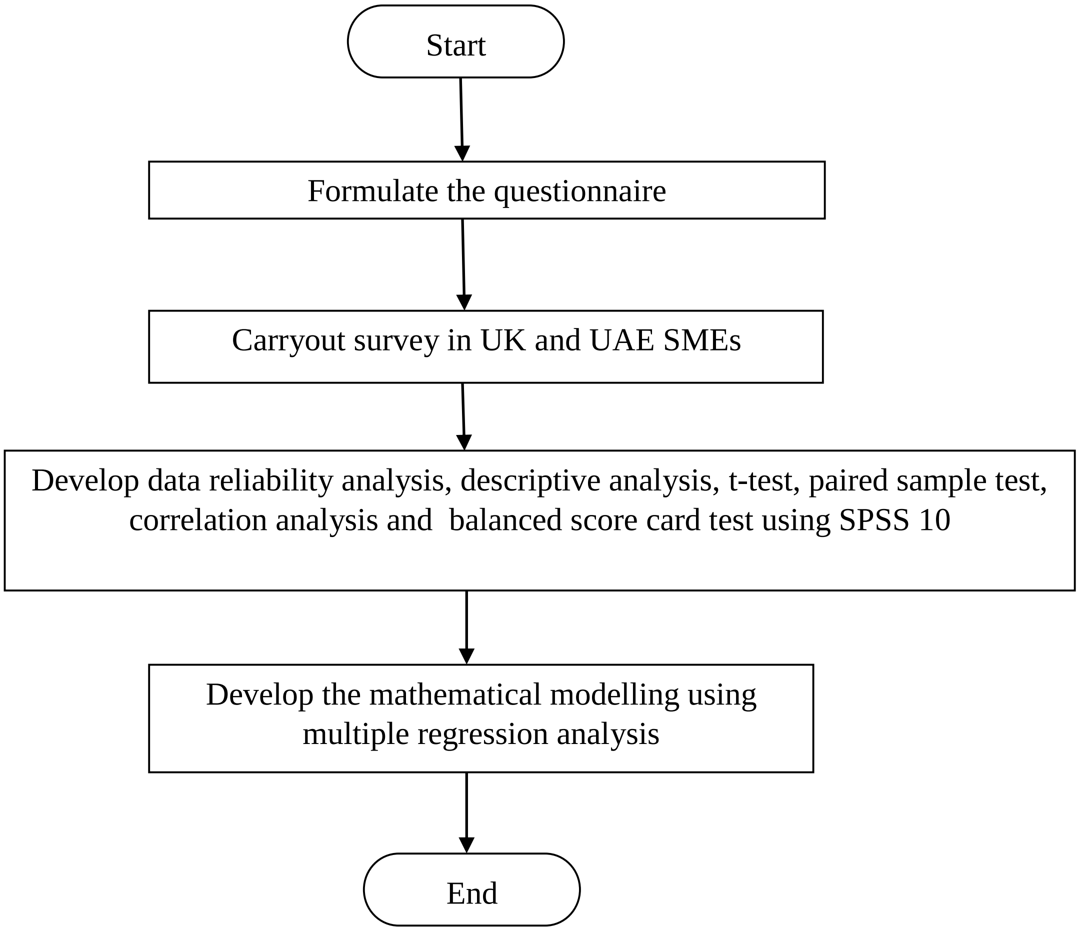


Figure 3.1 ERP cloud implementation success in UK and UAE manufacturing SMEs

3.4 Sampling method

The sampling technique used in this research study is simple random sampling. In a simple random sample (SRS) of a given size, all such subsets of the frame are given an equal probability. Therefore, each element of the frame has an equal probability of selection i.e the frame is not subdivided or partitioned. The target respondents were UK and UAE manufacturing SMEs.

3.4.1 Data processing

The study is based on primary data.

3.4.2 Primary data

The study depends mainly on primary data collected through structured questionnaire to obtain trustworthy opinions of the respondents.

3.5 Identification of ERP cloud implementation success factors

From various literatures, it has been identified 7 major ERP cloud success factors viz., leadership management, employee involvement, training and education, organization’s ability, working environment, cultural and motivational factors. Simultaneously. Additionally, ERP business processes such as production planning, monitoring, control stage and reliability were also considered as success factors.

3.6 Design of questionnaire

ERP should be fit to the user organization for it to work smoothly. It cannot be common for all types of organizations. The concept of organizational fit is therefore considered vital to the success of ERP systems in a diverse environment. The study of manufacturing SME characteristics is important. Comparison will give more information on how UK SMEs operate and operational needs, ERP module involved, vendor selections, skills required studied. The comparative analysis will give a reliable success factors to build the CBMERP model to the specific need of UAE SMEs. Survey information from UK and UAE

SMEs countries helped to evaluate the differences in the perception and application of cloud based ERP in both UK and UAE SMEs.

Samples collected were used to make a comparitive study between UAE and UK manufacturing SMEs to identify differences or similarities in the perception and use of cloud ERP system in both countries. The questionnaire focused mainly on ERP cloud implementation success factors and ERP cloud business process. 40 samples were considered: 20 each from UK and UAE SMEs. Prior to carry out the survey, the difference between ERP and ERP cloud concepts were explained to the participants to ensure that they have a clear knowledge of the information required for the survey. The questioned were carefully framed to extract informations on success factors, business processes, barriers for ERP cloud implementation and resources implication of ERP. Three sets of different questionnaires were designed to measure the respective level of importance rating. Five point Likert type scale was used to determine the levels of agreement with each statement. Moreover, the participants were asked for their overall views of ERP implementation success factors from their experience. Survey instrument developed for the emprical study is shown in the appendix (Questionaire 1).

3.7 Research hyphotheses

Based on the extant ltiereture, a number of hyphotheses were developed with respect to proposed relationship beteween cloud based ERP and operational performance overall performance and contextual variables. The variables include different factors surrounding the company's operations such as innovation culture, top management support, projeect management, staff skills and training, techology used, work culture and ethics. The questionaire was develped to test the following hypotheses:

H1 What are the motivational factors for adoption of cloud based ERP?

H2 Does employee involvment has a measurable impact on cloud based ERP programs?

H3 Is there a significant impact of cloud ERP on cost performance?

H4 Is there top management involvement in the plannning and implementation of cloud ERP system?

H5 Is there adequete investement for IT infrastructure to support cloud ERP?

H6 To what extend does the amount of training and education on ERP system, knowledge and experience affect the overall manufacturing performance in the company?

H7 Does the work culture have an effect on the success of cloud ERP?

H8 Is there a significant impact of cloud ERP on overall manufacturing performance

3.8 Validation of questionnaire

In this study, random sampling approach was used to minimize bias. Statistical analysis such as Cronbach's Alpha, regression analysis and factor analysis for additional measures of data validity and reliability were used to strengthen the validity of the emprical study. Descriptive statistics i.e. means, standard deviations, and correlation matrixes for all variables were calculated. A pilot test of the questionnaire was carried out to determine the suitability of the questionnaire. Inductive research approach was used to collect information, moving from specific to general information based questions. The researcher collected information from selected manufacturing organization in UK and UAE

SMEs. Empirical analysis was performed to evaluate the differences in the perception and application of cloud based ERP in both UK and UAE SMEs. The nature of exiting ERP systems and practices and related issues were evaluated. Companies were selected using as broad a representation of product, size and geographic dispersion as possible. The participants were asked selective questions. Analysis of these questions helped to identify the critical success factors to develop the cloud based ERP model to improve manufacturing performance.

CHAPTER 4
DATA ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter discusses the data analysis. Data reliability was determined by calculating coefficient alpha or Cronbach's Alpha. Demographical analysis of the respondents has been explained. Demographic variables such as designation, cloud plan, potential advantages, main criteria for implementation, ERP vendor selection basis, types of cloud services and main challenges, functional cloud ERP and resource implication of cloud ERP of the respondents were discussed. Descriptive statistical results for the seven factors (ERP cloud implementation success factors) and three factors (EROP cloud business process) in UK and UAE manufacturing SMEs. T-test was employed to find out the relationship between sample mean and population for UK and UAE SMEs. Paired t-test was employed to compare the ERP status in the SMEs. Karl Pearson coefficient of correlation was calculated to find out the correlation between relative factors such as performance evaluation through balance score card. Discussion on management and employee's approach to cloud ERP has been included. Finally, this chapter discusses the empirical relationship (multiple regression model) between ERP cloud implementation parameters (predictors) and ERP cloud implementation success (response). From the empirical analysis, a number of CSFs have been identified as the essential elements to develop the conceptual cloud based manufacturing ERP (CBMERP) framework discussed in chapter 5.

4.1 Data reliability analysis

Data collected from the survey was analysed by using SPSS software. Data reliability was determined by calculating coefficient alpha or Cronbach Alpha.

Coefficient Alpha or Cronbach Alpha is the average of all possible split half-coefficients resulting from different ways of splitting the scale items.

Table 4.1 is shows data reliability statistics without demographic variables.

Table 4.1 Data reliability statistics without demographic variables

Country of origin	Number of items	Data reliability Cronbach Alpha
UAE manufacturing SMEs	34	0.698
UK manufacturing SMEs	34	0.536

Cronbach's Alpha is the most common measure of internal consistency (reliability). It is most commonly used when there is multiple Likerts' questions in a survey/questionnaire that form a scale and if you wish to determine that the scale is reliable. In order to understand whether the questions in the questionnaire are measured reliably the same latent variable. The thirty-two questions that have been labelled "A1" through to M4 from the reliability statistic table showed a Cronbach's Alpha of 0.698 (UAE) and 0.536 (UK). This designates a high level of internal consistency for the scale in this research with this specific sample.

4.2 Demographical analysis

Table 4.2 shows group wise respondent's details. From the table, it can be inferred that more than 50% of participants belong to top and senior level management. In UAE and UK, the manufacturing SMEs are prepared and eager to implement ERP cloud within one 1-2 years. These SMEs appear to have more focus towards strategic clouds.

Table 4.2 Demographical analysis for group wise respondent's details.

Characteristics	UAE manufacturing SMEs (percentage/no)	UK manufacturing SMEs (percentage/no)
Position		
• Top management	15(3)	25(5)
• Senior management	35(7)	30(6)
• Middle management	20(4)	25(5)
• Junior management	30(6)	20(4)
Cloud ERP start up		
• Less than 1 year	15(3)	15(3)
• 1-2 year	25(5)	30(6)
• 2.1-3 year	35(7)	15(3
• 3.1-4 year	10(2)	20(4)
• More than 4 years	15(3)	20(4)
Main criteria for ERP cloud		
• Technical	5(1)	15(3)
• Strategic	40(8)	25(5)
• Functional	20(4)	15(3)
• Finance	20(4)	20(4)
• Others	15(3)	25(5)

4.1.1 Potential advantages of SMEs in UAE

Table 4.3 and Figure 4.1 show the potential advantages of UAE SMEs through implementation of cloud-based ERP system.

Table 4.3 UAE SMEs' potential advantages

SMEs' potential advantages	Frequency	Percent
Organizing/integrating data	4	20.0
Cost saving	3	15.0
Accessibility	5	25.0
Productivity	3	15.0
Reporting	5	25.0
Total	20	100.0

Table 4.3 and Figure 4.1 indicate that UAE manufacturing SMEs gain 25% of potential advantage each in accessibility and reporting. It also shows that 20% of advantages are in organizing/integrating the data. The finding also indicates that the UAE SMEs have 15% of advantage in cost saving and productivity.

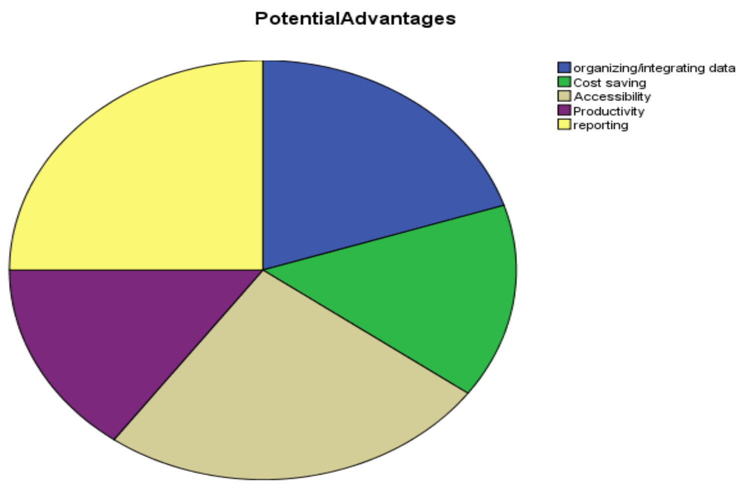


Figure 4.1 UAE manufacturing SMEs' potential advantages

4.1.2 UK Manufacturing SMEs' potential advantages

Table 4.4 and Figure 4.2 show UK SMEs' potential advantages.

Table 4.4 UK SMEs' potential advantages

SMEs' potential advantages	Frequency	Percentage
Organizing/integrating data	4	20.0
Cost saving	6	30.0
Accessibility	4	20.0
Productivity	4	20.0
Reporting	2	10.0
Total	20	100.0

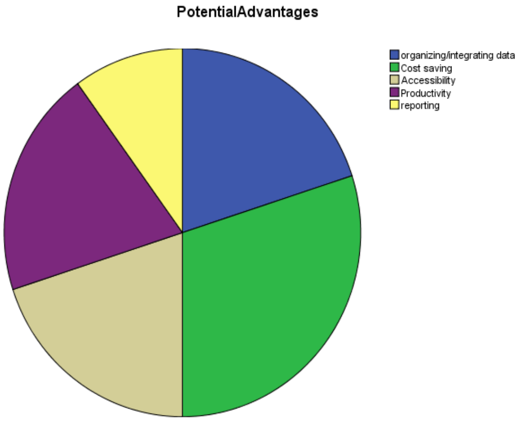


Figure 4.2 UK SMEs' potential advantages

Table 4.4 and Figure 4.2 indicate that UK manufacturing SMEs gain 30% of potential advantage in cost saving. Analysis also shows that 20% of advantages are gained each in organizing/integrating data, accessibility and productivity. Findings also indicate that the SMEs have 10% of advantage each in reporting. SMEs in UAE prefer cloud ERP for reporting and accessibility, whereas the SMEs in UK prefer cloud based ERP for cost saving. This reason for this is UAE SMEs lacks knowledge how to exploit and integrate modules effectively to minimise duplication of information flow'.

4.1.3 Vendor selection approach in UAE SMEs

Table 4.5 and Figure 4.3 show UAE SME's vendor selection approach. Analysis shows that 35% of the respondent agreed that vendor selection in UAE SMEs is based on vendor reputation 30% select vendors on cost criteria. Data analysis also indicates that in 20% of SMEs, vendor selection is driven by decision of the senior management and followed by 15% by systematic selection.

Table 4.5 UAE SMEs vendor selection

Vendor Selection	Frequency	Percentage
Decision by senior management	4	20.0
Based on cost	6	30.0
Based on reputation	7	35.0
Systematic selection	3	15.0
Total	20	100.0

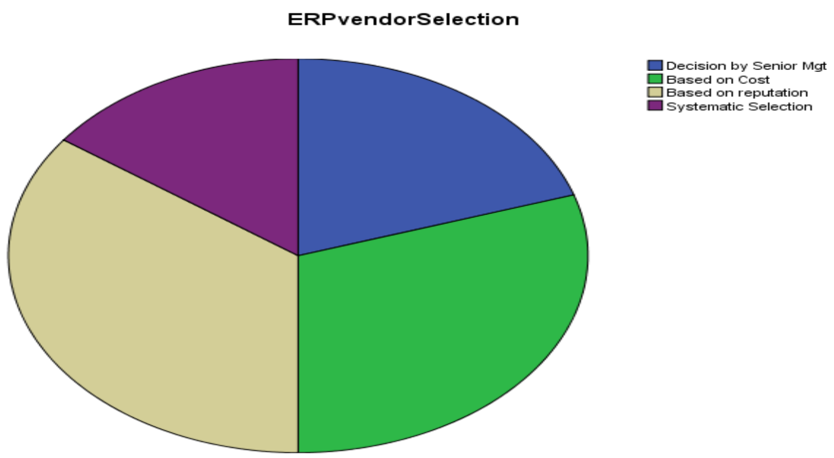


Figure 4.3 Vendor selection in UAE SMEs

4.1.4 Vendor selection in UK SMEs

Table 4.6 and Figure 4.4 show vendor selection approach in UK SMEs

Table 4.6 Vendor selection in UK SMEs

Vendor Selection	Frequency	Percentage
Decision by senior management	3	15.0
Based on cost	3	15.0
Based on reputation	10	50.0
Systematic selection	4	20.0
Total	20	100.0

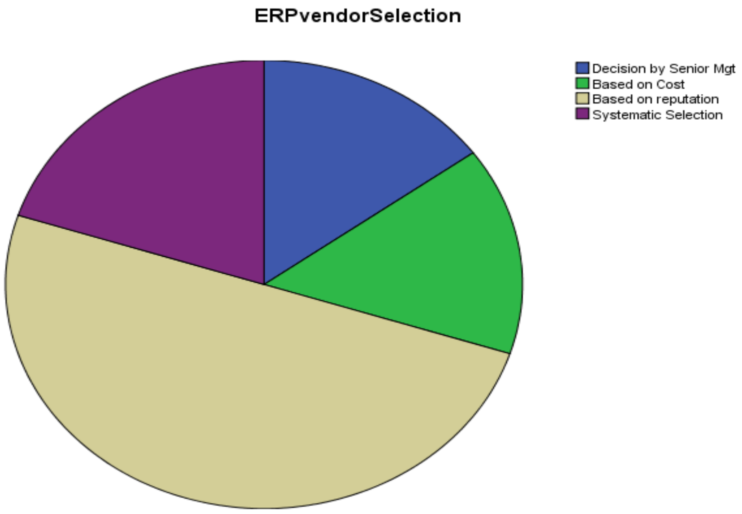


Figure 4.4 Vendor selection in UK SMEs

Table 4.6 indicates that vendor selection in UK SMEs is based on reputation (50%). In 20% of SMEs reported that vendor choice is based on systematic selection. Analysis also indicated that in UK manufacturing SMEs vendor selection is driven by decision from the senior management and cost with a frequency of 15% each. Vendor selection in UAE SMEs is based on vendor's reputation.

4.1.5 UAE SMEs preference on cloud based ERP

Table 4.7 and Figure 4.5 show that SMEs in UAE prefer cloud based ERP systems.

Table 4.7 UAE SME's preference on type of cloud services

Preferred cloud types	Frequency	Percentage
Infrastructure as a service (IaaS)	5	25.0
Platform as a service (Paas)	7	35.0
Software as a Service(Saas)	8	40.0
Total	20	100.0

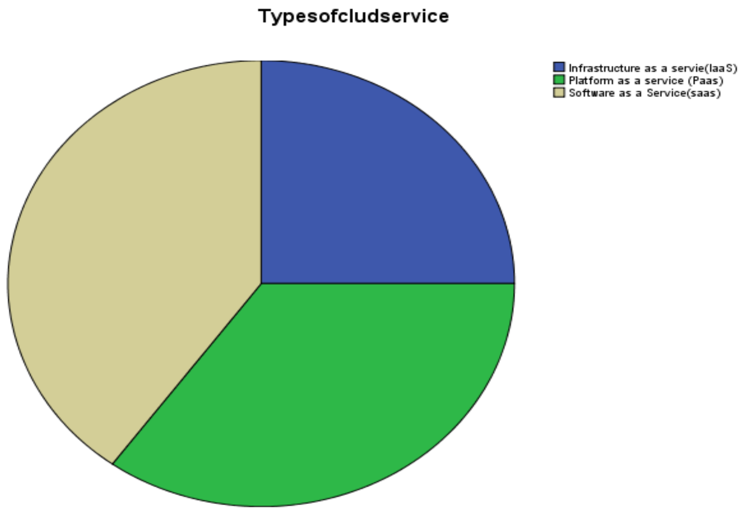


Figure 4.5 UAE SME's preference on type of cloud services

Data analysis in Table 4.7 and Figure 4.5 show that UAE SMEs select 'software' as a service with a frequency of 40%. It is followed by 'platform' as a service (35%) and 'Infrastructure' as a service (25%).

4.1.5 UK SME's preference on type of cloud services

Table 4.8 and Figure 4.6 show UK SME's preference on cloud types.

Table 4.8 UK SMEs preference on types of cloud services

Preferred cloud types	Frequency	Percentage
Infrastructure as a service(IaaS)	4	20.0
Platform as a service (Paas)	7	35.0
Software as a Service(Saas)	9	45.0
Total	20	100.0

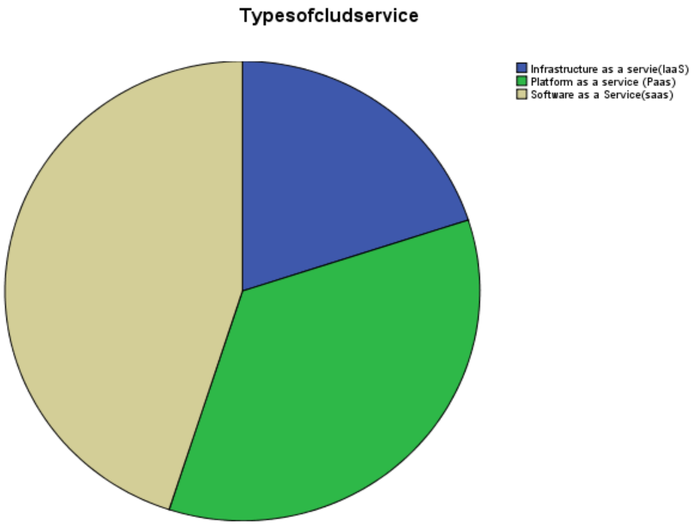


Figure 4.6 UK SME’s preference on types of cloud services

Table 4.8 and Figure 4.6 indicate that the UK SMEs select ERP software as a service with a frequency of 45%. It was followed by platform as a service (35%) and infrastructure as a service (20%). It can be concluded that both UAE and UK SMEs prefer cloud based ERP clouds for software as service.

4.1.7 Employees figure in UK SMEs

Table 4.9 and Figure 4.7 show employee figures in UK SMEs. Analysis indicates employee figure in UK SMES were less than 5 to 20 which has a frequency of 25% each. The frequency of employees less than 35 was seen to be 20%, employees with less than 50 is 15% and more than 50 is 15%.

Table 4.9 Number of employees in UK SMEs

No of employees	Frequency	Percent
Less than five	5	25.0
6-20	5	25.0
21-35	4	20.0
36-50	3	15.0
More than 50	3	15.0
Total	20	100.0

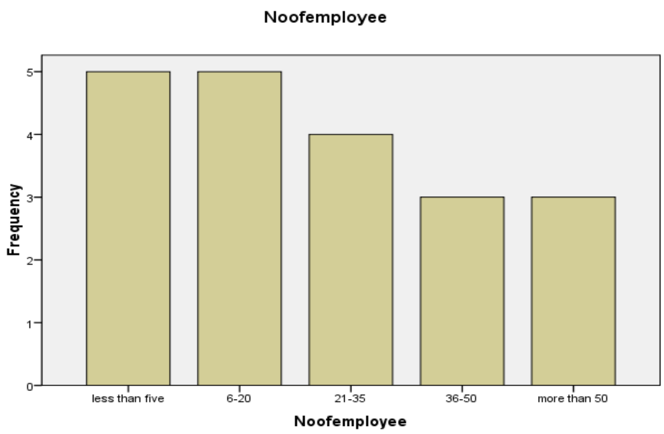


Figure 4.7 No of employees in UK manufacturing SMEs

4.1.8 No of employees in UAE SMEs

Table 4.10 and Figure 4.8 show employee figure in UAE SMEs.

Table 4.10 No of employees in UAE manufacturing SMEs

No of employees	Frequency	Percentage
Less than 5	5	25.0
6-20	4	20.0
21-35	4	20.0
36-50	4	20.0
More than 50	3	15.0
Total	20	100.0

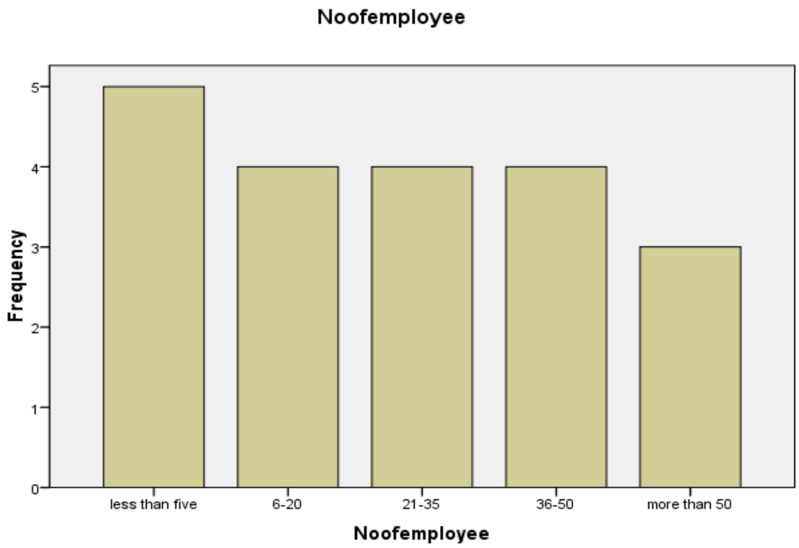


Figure 4.8 No of employees in UAE SMEs

Table 4.10 and Figure 4.8 show that the UAE SMEs employed less than 5 workers showing a frequency of 25%; SMEs with less than 20 employees have a frequency of 20%. The frequency of employees less than 35 and less than 50 are 20% each. The frequency of employees more than 50 is 15%.

From Figure 4.8, it is inferred that the number of employees were less than 20 in majority of the companies considered in the survey from the UK SMEs. In UAE SMEs, majority of the companies have less than 5 employees. In both UK and UAE based manufacturing SMEs, companies having more than 50 employees have the least frequency i.e. 15% each.

4.1.9 Major challenges identified prior to ERP implementation in UK SMEs

Table 4.11 and Figure 4.9 indicate that the major challenges identified prior ERP implementation in UK SMEs.

Table 4.11 Major challenges identified prior to ERP implementation in UK SMEs

Major challenges	Frequency	Percentage
Poor planning	2	10.0
Weak project team	7	35.0
Resistance to change	4	20.0
Weak risk strategies	2	10.0
Under estimating resources and time	5	25.0
Total	20	100.0

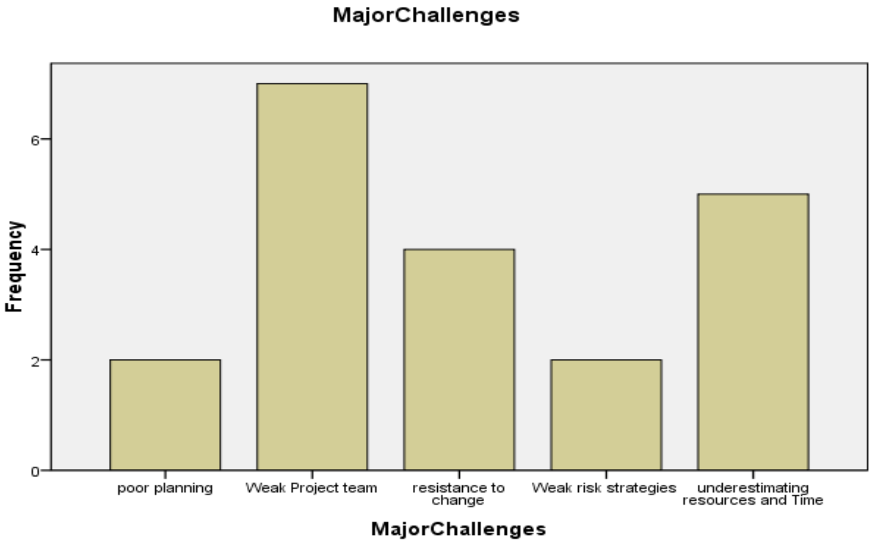


Figure 4.9 Major challenges identified prior to ERP implementation in UK manufacturing SMEs

Table 4.11 and Figure 4.9 show that in majority of the UK SMEs, major challenge identified prior to ERP implementation was ineffective project team (35%).The next major challenges identified were under estimating resources, time for implementation (25%) and resistance to change (20%). This is followed by poor planning and less efficient risk management strategies with 10% each.

4.1.10 Major challenges identified prior to ERP implementation in UAE SMEs

Table 4.12 and Figure 4.10 highlight the major challenges identified in UAE SMEs prior to ERP implementation.

Table 4.12 Main challenges identified prior ERP implementation in UAE SMEs

Major challenges	Frequency	Percentage
Poor planning	4	20.0
Weak project team	5	25.0
Resistance to change	5	25.0
Weak risk strategies	2	10.0
Under estimating resources and Time	4	20.0
Total	20	100.0

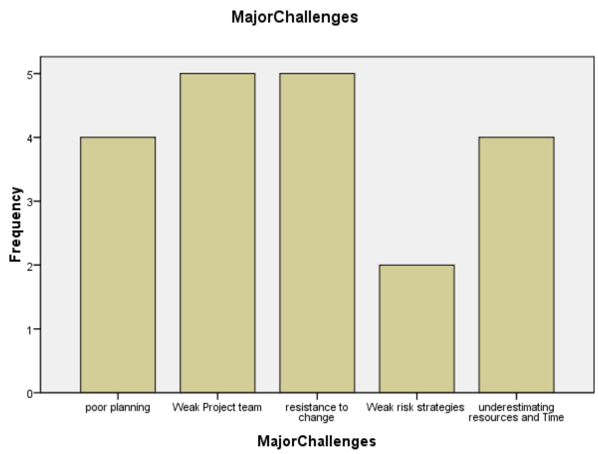


Figure 4.10 Major challenges identified prior to ERP implementation in UAE SMEs

Table 4.12 and Figure 4.10 indicate that in UAE SMEs, major challenge identified prior to ERP implementation was weak project team and resistance to change with frequency of 25% each. The next major challenges identified were under estimating resources, implementation time (25%) and poor planning with frequency of 20% each. Analysis also shows that UK SMEs suffered from companies' poor risk management strategies with 10% of frequency.

From the analysis, it can be inferred that the major challenge in UK SMEs is ineffective project team, whereas in UAE based SMEs, major challenges were identified as poor project team and resistance to change. Poor risk management strategies was the least important challenge in both UK and UAE SMEs.

4.1.11 Major issues in incorporating ERP system to cloud ERP in UK SMEs

Table 4.13 and Figure 4.11 show major issues in incorporating cloud technology in ERP system in UK SMEs.

Table 4.13 Main issues in incorporating cloud technology in ERP system in UK SMEs

Major issues	Frequency	Percentage
Limited resources	4	20.0
High cost	6	30.0
Perception	6	30.0
Awareness	4	20.0
Total	20	100.0

Figure 4.11 Main issues in incorporating cloud technology in ERP systems in UK SMEs

Table 4.13 and Figure 4.11 indicate that main issues in incorporating cloud technology in ERP system to cloud ERP in UK SMEs were high cost and wrong perception with frequency of 30% each. It is followed by limited resources and lack of awareness of cloud ERP, with 20% each.

4.1.12 Major issues envisaged in incorporating ERP system cloud ERP in UAE SMEs

Table 4.14 and Figure 4.12 show major issues in incorporating cloud technology to ERP system in UAE SMEs. In UAE SMEs, limited resources were identified as a major challenge with a frequency of 35%, followed by lack of awareness with 30% frequency. The next main issue is high cost with frequency of 25%, followed by wrong perception with 10% of frequency.

Table 4.14 Main issues envisage in incorporating ERP system to cloud ERP in UAE manufacturing SMEs

Major Issues	Frequency	Percentage
Limited resources	7	35.0
High cost	5	25.0
Perception	2	10.0
Awareness	6	30.0
Total	20	100.0

Figure 4.12 Main issues envisaged in incorporating ERP system to cloud ERP in UAE manufacturing SMEs

It can be inferred that main issues during incorporation of ERP cloud in UK based SMEs were high cost and wrong perception, whereas in UAE SMEs, lack support for resources and lack of awareness seems to be major problems.

4.1.13 Function strategically integrated ERP cloud in UK SMEs

Table 4.15 and Figure 4.13 show that majority of UK SMEs use ERP cloud specifically for inventory management which shows a frequency of 35%. This is followed by supply chain management with frequency of 30%. Furthermore, ERP cloud functions were seem to be strategical planning with 20% frequency, customer relation management (CRM) with 10% frequency and accounting 5%.

Table 4.15   Functions strategically integrated ERP cloud in UK SMEs

ERP function	Frequency	Percentage
Accounting	1	5.0
CRM	2	10.0
Inventory	7	35.0
SCM	6	30.0
Planning	4	20.0
Total	20	100.0

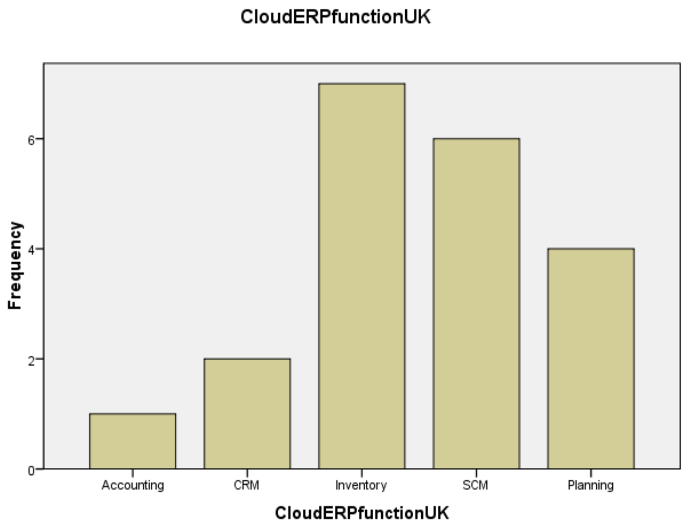


Figure 4.13 Functions strategically integrated ERP cloud in UK SMEs

4.1.14 Function strategically integrated ERP cloud in UAE SMEs

Table 4.16 and Figure 4.14 show functions strategically integrated ERP in UAE manufacturing SMEs.

Table 4.16 Function strategically integrated ERP in UAE SMEs

ERP function	Frequency	Percentage
Accounting	3	15.0
CRM	1	5.0
Inventory	10	50.0
SCM	4	20.0
HRM	1	5.0
Planning	1	5.0
Total	20	100.0

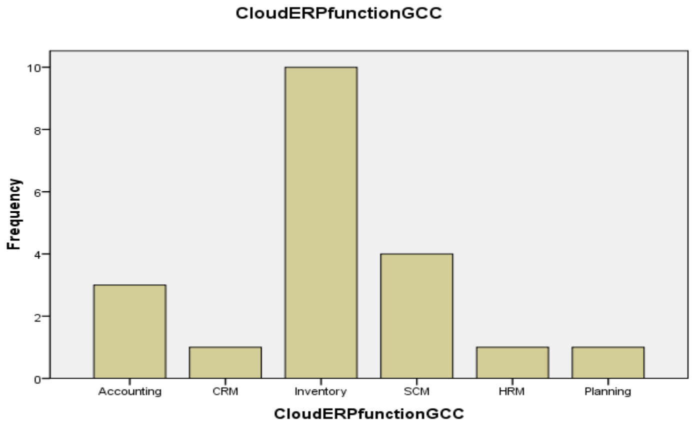


Figure 4.14 Function strategically integrated ERP cloud in UAE SMEs

Table 4.16 and Figure 4.14 indicate that the functions of strategically integrated ERP cloud in UAE SMEs. Analysis shows that majority of the SMEs uses basic ERP for inventory management which has a frequency of 50%. This is followed by supply chain management with frequency of 20%. Additionally, Basic ERP functions show 15% frequency with CRM and planning each with 5% frequency.

4.1.15 Resources of implication in UK SMEs

Resources such as financial resources, access to raw material, relationship between suppliers and distributors etc play an important role in providing firms competitive advantage over other firms. Any problem in getting access to any of the resource can cause adverse implications to the firm and hence cause firm losing its market share in the industry.

Table 4.17 and Figure 4.15 show resource implication in implementing ERP in UK SMEs.

Table 4.17 Resource implication in implementing ERP cloud in UK SMEs

Resources implication	Frequency	Percentage
Training	8	40.0
Materials	8	40.0
Funding	1	5.0
Additional man power	1	5.0
Additional working hours	1	5.0
Additional spaces	1	5.0
Total	20	100.0

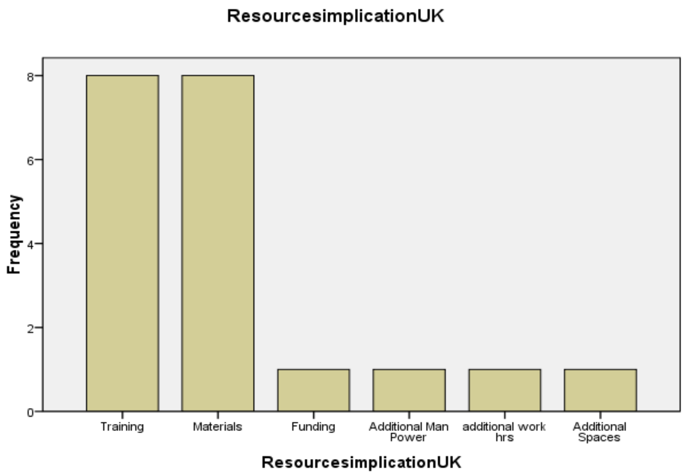


Figure 4.15 Resource implication in implementing ERP cloud in UK SMEs

Table 4.17 and Figure 4.15 show the frequency of resource implication among employees in UK manufacturing SMEs. Majority of the UK employees preferred more resources for training and education and materials with a frequency of 40% each. Other areas identified where resource allocation should be increased were manpower, additional working hours and work spaces; this shows a frequency of 5% each.

4.1.16 Resources implication in UAE SMEs

Table 4.18 and Figure 4.16 show that resources of implication of implementing ERP cloud in UAE manufacturing SMEs.

Table 4.18 resources Implication on implementing ERP cloud in UAE SMEs

Resources implication	Frequency	Percentage
New technology	3	15.0
Training	7	35.0
Materials	9	45.0
Funding	1	5.0
Total	20	100.0

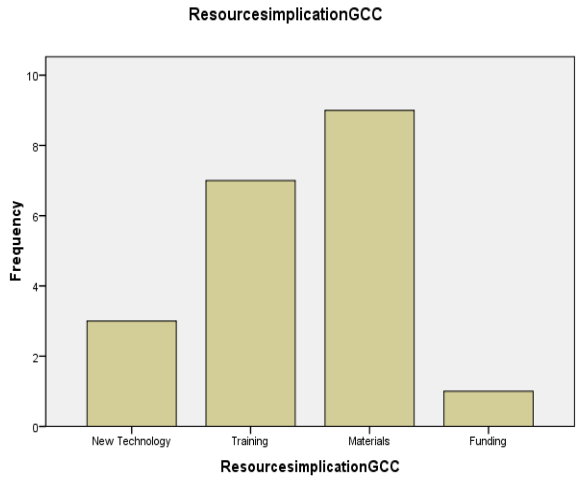


Figure 4.16 Resources implication on implementing ERP cloud in UAE SMEs

Majority of the employees in UAE SMEs preferred more resources to be allocated for innovative materials analysis. This preference shows frequency of 45% followed by training with a frequency of 35%. Support for technology was 15% and funding 5%.

From analysis, it can be inferred that resource implication in both UK and UAE based manufacturing SMEs, the employees feel that more resources must be invested in training, education and new materials for ERP cloud to work effectively.

4.1.17 Cross tab for start-up cloud and ERP Function

Cross tabulations are simply data tables that present the results of the entire group of respondents as well as results from sub-groups of survey respondents. Cross tabulations enable you to examine relationships within the data that might not be readily apparent when analysing total survey responses. Table 4.19 and 4.20 show cross tabulation for start-up plan for cloud ERP and cloud ERP function in both UK and UAE SMEs.

Table 4.19 Cross tabulation for start-up plan for cloud ERP and cloud ERP function in UAE and UK SMEs

Cross Tab		Cloud ERP function UAE						Total
		Accounting	CRM	Inventory	SCM	HRM	Planning	
Start-up plan cloud ERP	Less than one Year	0	0	1	2	0	0	3
	1-2 years	0	1	3	1	0	0	5
	2.1-3 years	2	0	2	1	1	1	7
	3.1-4 years	1	0	1	0	0	0	2
	more than 5 years	0	0	3	0	0	0	3
Total		3	1	10	4	1	1	20

Cross Tab		Cloud ERP function UK					Total
		Accounting	CRM	Inventory	SCM	Planning	
Start-up plan cloud ERP	Less than one year	0	0	2	0	1	3
	1-2 years	0	1	3	2	0	6
	2.1-3 years	0	0	1	1	1	3
	3.1-4 years	1	0	0	2	1	4
	more than 5 years	0	1	1	1	1	4
Total		1	2	7	6	4	20

Majority of SMEs in UK and UAE use ERP cloud for inventory control. Analysis shows that UAE companies took a period of between 2-3 years to implement ERP system; but in UK SMEs the implementation period was between 1-2 years. It can be concluded that majority of both UK and UAE SMEs took less than 3 years to implement ERP to optimize inventory control.

4.1.18 Cross tabulation for start-up cloud and resource implication

Table 4.21 and 4.22 show cross tabulation for start-up plan cloud ERP resources implication in UK and UAE manufacturing SMEs.

Table 4.21 Cross tabulation for start-up plan cloud ERP and resources implication for UAE SMEs

Cross Tab		Resources implication in UAE SMEs				Total
		New Technology	Training	Material	Funding	
Start-up plan cloud ERP	Less than one year	1	0	1	1	3
	1-2 years	0	1	4	0	5
	2.1-3 years	0	5	2	0	7
	3.1-4 years	1	0	1	0	2
	more than 5 years	1	1	1	0	3
Total		3	7	9	1	20

Table 4.22 Cross Tabulation for start plan cloud ERP and resources implication for UK SMEs table

cross tab		Resources implication UK						
		Training	Materials	Funding	Additional Man Power	additional work hrs	Additional Spaces	Total
Start-up plan cloud ERP	Less than one year	1	1	0	0	1	0	3
	1-2 years	2	3	0	1	0	0	6
	2.1-3 years	1	1	0	0	0	1	3
	3.1-4 years	2	1	1	0	0	0	4
	more than 5 years	2	2	0	0	0	0	4
Total		8	8	1	1	1	1	20

Table 4.21 and 4.22 indicate that majority of employees prefer resource implication through training and educational material and ERP cloud was implemented within 2.1 - 3 years. The cross tabulation for UK SMEs indicates that majority of UK employee prefer resource implication through training and material. In UK SMEs ERP cloud was implemented in between 1-2 years. It can be concluded that majority of both UK and UAE SMEs implemented cloud ERP in less than 3 years. These companies prefer resource implication through training and material.

4.2 Descriptive statistical analysis

Arithmetic mean is the summation of various values of the variables and divides the total by the number of items.

$$\bar{\mathbf{X}} = \frac{\sum \mathbf{X}}{\boldsymbol{N}}$$

$\bar{\mathbf{X}}$= Arithemetic mean,

$\sum \mathbf{X}$ **=** Sum of all the values of the variable (X_{1}+X_{2}+X_{3}+.........................+Xn)

N= Number of observations

Arithmetic mean is relatively reliable in the sense that it does not vary much when repeated samples are taken from the same population and is the centre of gravity balancing the values on either side of it. **Standard deviation** is also known as root mean square deviation since it is the square root of the means of the squared deviations from the arithmetic mean. Small value of standard deviation means high degree of uniformity of the observations as well as homogeneity of a series.

$$\boldsymbol{Standard\ deviation} = \boldsymbol{\sigma} = \sqrt{\frac{\sum(\mathbf{X} - \bar{\mathbf{X}})^2}{\mathbf{N}}}$$

Measures of **Skewness** gives information on the direction and extent of skewness. Skewness also provides information on the direction of the variation or the deviation from symmetry. It is an indication of the symmetry of the distribution. **Kurtosis** provides information about the peakedness of the distribution. Kurtosis refers to the degree of flatness or peakedness in the region about the mode of a frequency curve. If the distribution is perfectly normal, then the value for the Skewness and Kurtosis are considered zero which is an uncommon occurrence in the social sciences (Julie and Pallant ,2013). Table 4.23 and 4.24 show parameters mean, standard deviation, Skewness and Kurtosis analysis for UK and UAE SMEs.

Table 4.23 Parameters mean, standard deviation, Skewness and Kurtosis analysis for UK and UAE SMEs							
Description	Sample size	Mean	Standard Deviation	Skewness		Description	
				Statistic	Standard Error	Statistic	Standard Error
Management Leadership							
Management Commitment	20	4.5500	.51042	-.218	.512	-2.183	.992
Empowering Employees by Management	20	3.7000	1.08094	-.717	.512	.550	.992
Provision of Sufficient resources	20	3.3000	.80131	-1.309	.512	2.256	.992
Employee Involvement							
Familiarities ERP module Data Manipulation	20	3.9500	1.14593	-1.292	.512	1.236	.992
Flexibility	20	3.1000	.96791	-.217	.512	-.060	.992
Training and Education							
Conduct of Employee training	20	4.0500	1.09904	-1.429	.512	2.063	.992
Provision of Continuous learning	20	3.4000	1.31389	.087	.512	-1.246	.992
Production Planning Stage							
Selection raw material ERP Cloud	20	3.8000	1.32188	-1.112	.512	.219	.992
Process Innovation	20	3.4500	.94451	-.674	.512	1.277	.992
Design Innovation	20	3.6000	1.23117	-.820	.512	.170	.992
Production Monitoring Stage							
Measuring and Monitoring ERP	20	3.2500	1.01955	-.559	.512	-.354	.992
Information Capturing	20	3.6500	.74516	-.151	.512	.082	.992

Production Control Stage							
Multi task performance	20	3.8000	1.23969	-.869	.512	-.227	.992
Automatic and Incremental upgrade	20	3.5500	.75915	.215	.512	-.110	.992
Production System Reliability							
Intercept	20	4.1500	.98809	-1.056	.512	.321	.992
Consistency	20	3.4500	.75915	-.215	.512	-.110	.992
Clarity	20	4.1500	1.13671	-1.518	.512	2.023	.992
Easy to work	20	3.6000	.75394	.033	.512	-.073	.992
Barriers with ERP Cloud Techniques							
Information Transparency	20	3.3500	1.08942	-.793	.512	.598	.992
Data Security	20	3.0500	.99868	-.108	.512	-.410	.992
Integration Difficulties	20	3.5000	.88852	-.250	.512	-.497	.992
Individual Customization	20	3.4500	1.35627	-.235	.512	-.940	.992
Organization ability							
Willingness to change	20	3.9000	1.07115	-.640	.512	-.723	.992
Willingness to adopt	20	4.1500	.87509	-.839	.512	.254	.992
Readiness to technological change	20	3.8500	.93330	-.107	.512	-1.077	.992
ERP with Work Environment							
Provision pleasant working environment	20	3.4000	1.50088	-.357	.512	-1.298	.992
Adaptation of employee satisfaction initiatives	20	3.3000	1.26074	-.109	.512	-1.252	.992
ERP with Culture Factor							
Good results rewarded	20	3.3000	.97872	-.307	.512	.548	.992
Deadlines are flexible	20	4.0500	.94451	-.940	.512	.405	.992
Policies and Procedures are formal	20	4.0500	1.09904	-1.429	.512	2.063	.992

ERP with Motivational Factor							
Replace the legacy system	20	3.4500	.82558	.176	.512	-.212	.992
Ease to upgrading system	20	4.1000	1.25237	-1.636	.512	2.164	.992
Simplify and standardize	20	3.5500	.75915	.215	.512	-.110	.992
Link global activities	20	3.9000	1.07115	-1.211	.512	1.647	992

In the different domains among the factors for UK manufacturing SMEs, mean is highest for management commitment (4.55) followed by intercept, clarity and willingness to adapt (4.15). Standard deviation is very high for empowering employees (1.80), followed by continuous learning (1.32). The Skewness value is negative for all the factors except automatic and incremental upgrade, easy to upgrade and simplifying and standardizing practices, indicating the clustering of the scores at high end (right hand side of the graph). According to Gothari (2013), with reasonably large samples, Skewness will not make a substantive difference in the analysis.

Table 4.24 Parameters mean, standard deviation, Skewness and Kurtosis analysis for UAE SMEs								
No	Description	Sample size	Mean	Standard Deviation	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
	Management Leadership							
1	Management Commitment	20	4.4500	.60481	-.583	.512	-.459	.992
2	Empowering Employees by Management	20	3.4000	.75394	-1.670	.512	4.220	.992
3	Provision of Sufficient resources	20	3.5000	.60698	-.785	.512	-.213	.992
	Employee Involvement							
1	Familiarities ERP module Data Manipulation	20	2.6000	.68056	.712	.512	-.446	.992
2	Flexibility	20	3.5000	.51299	.000	.512	-2.235	.992
	Training and Education							
1	Conduct of Employee training	20	3.4000	.75394	-1.670	.512	4.220	.992
2	Provision of Continuous learning	20	2.5500	.60481	.583	.512	-.459	.992
	Production Planning Stage							
1	Selection raw material ERP Cloud	20	4.4500	.60481	-.583	.512	-.459	.992
2	Process Innovation	20	2.4000	.59824	-.393	.512	-.570	.992
3	Design Innovation	20	2.6000	.50262	-.442	.512	-2.018	.992
	Production Monitoring Stage							
1	Measuring and Monitoring ERP	20	2.5500	.60481	.583	.512	-.459	.992
2	Information Capturing	20	3.4500	.51042	.218	.512	-2.183	.992
	Production Control Stage							
1	Multi task performance	20	3.4000	.82078	-.914	.512	2.991	.992
2	Automatic and Incremental upgrade	20	2.6000	.68056	.712	.512	-.446	.992

	Production System Reliability							
1	Intercept UAE	20	2.7500	.78640	1.218	.512	2.248	.992
2	Consistency	20	3.4500	.51042	.218	.512	-2.183	.992
3	Clarity	20	4.4500	.51042	.218	.512	-2.183	.992
4	Easy to work	20	3.4000	.59824	-.393	.512	-.570	.992
	Barriers with ERP Cloud Techniques							
1	Information Transparency	20	2.5000	.60698	-.785	.512	-.213	.992
2	Data Security	20	2.6000	.59824	.393	.512	-.570	.992
3	Integration Difficulties	20	2.6500	.74516	1.546	.512	4.018	.992
4	Individual Customization	20	2.4500	.51042	.218	.512	-2.183	.992
	Organization ability							
1	Willingness to change	20	3.3500	.58714	-.212	.512	-.552	.992
2	Willingness to adopt	20	2.9000	.78807	.186	.512	-1.308	.992
3	Readiness to technological change	20	3.0500	.68633	-.062	.512	-.630	.992
	ERP with Work Environment							
1	Provision pleasant working environment	20	2.7000	1.21828	.838	.512	-.073	.992
2	Adaptation of employee satisfaction initiatives	20	2.9500	1.09904	.372	.512	-.551	.992
	ERP with Culture Factor							
1	Good results rewarded	20	4.4000	.59824	-.393	.512	-.570	.992
2	Deadlines are flexible	20	3.3500	.67082	. -.549	.512	--.548	.992
3	Policies and Procedures are formal	20	3.5000	.76089	-1.991	.512	5.136	.992
	ERP with Motivational Factor							
1	Replace the legacy system	20	3.5500	.51042	-.218	.512	-2.183	.992
2	Ease to upgrading system	20	2.6500	.81273	1.420	.512	2.376	.992
3	Simplify and standardize	20	4.4000	.59824	-.393	.512	-.570	.992
4	Link global activities	20	3.5500	.60481	.583	.512	-.459	992

In the case of UAE SMEs, mean shows the highest value for management commitment, selection of raw material and clarity (4.45) followed by results rewarded and simplifying and standardizing processes (4.45). Standard deviation shows the highest value for providing provision for pleasant working environment for employees (1.2), followed by adaptation of employee satisfaction initiatives (1.099). The Skewness value is distributed almost equally into positive and negative values, indicating that the values are distributed both of right and left hand side of the graph.

4.2.1 Factors Mean Analysis

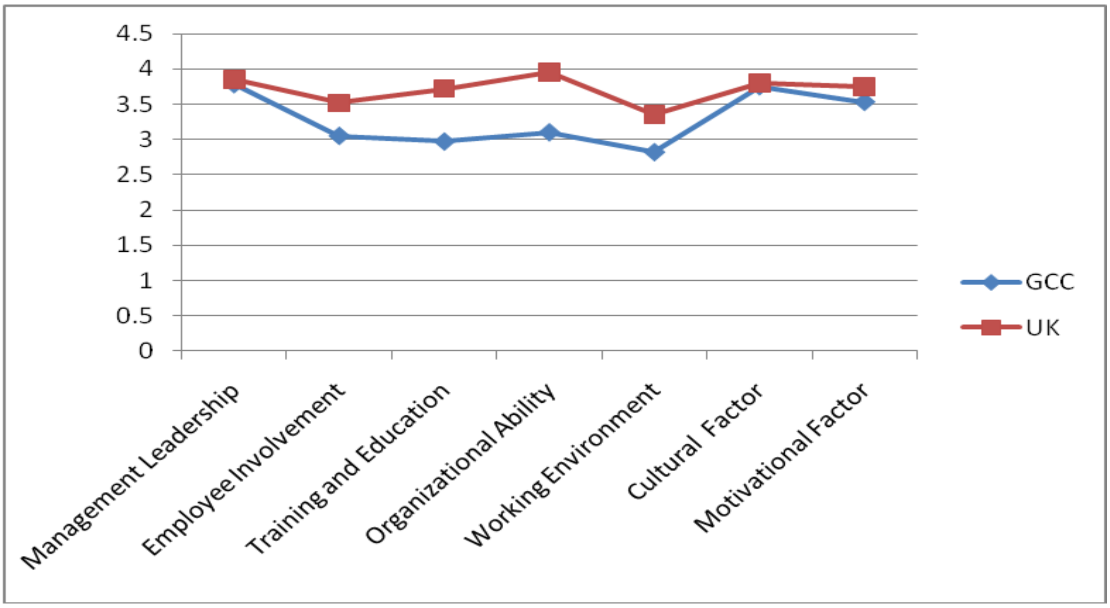


Figure 4.17 Factors mean analysis for ERP cloud in UAE and UK SMEs

From Figure 4.17, it is inferred that the mean values for ERP implementation success factors are higher in UK SMEs when compared to ERP SMEs in UAE. The mean value of management leadership and cultural factor are nearly equal for UAE and UK SMEs.

4.3 T- test analysis

T- statistic (T-distribution) is defined as,

$$t\ statistic = \frac{\bar{X} - \mu}{S} * \sqrt{n}$$

$\bar{X}$ = Mean of the samples

μ = Actual or hypothetical mean of the Population

n=Sample size

S =Standard deviation of the sample

Because the sample size is much smaller than the population size, ‘one sample t test’ was chosen for the analysis in this study. Generally, one-sample t-test is used for testing whether the mean of one metric variable is equal to some hypothesized population value.

4.3.1 T Test results for UK and UAE SMEs

Table 4.25 and 4.26 show T test result for UK and UAE manufacturing SMEs

Table 4.25 T-test result for UK manufacturing SMEs (one-sample test)

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Management leadership UK	34.355	19	.000	3.85000	3.6154	4.0846
Employee Involvement UK	23.942	19	.000	3.52500	3.2168	3.8332
Training and Education UK	20.346	19	.000	3.72500	3.3418	4.1082
Production Planning UK	20.116	19	.000	3.61667	3.2404	3.9930
Production Monitoring UK	22.480	19	.000	3.45000	3.1288	3.7712
Production Controlling UK	23.076	19	.000	3.67500	3.3417	4.0083
Reliability UK	34.200	19	.000	3.83750	3.6026	4.0724
ERP Barrier UK	27.051	19	.000	3.33750	3.0793	3.5957
Organization ability UK	24.757	19	.000	3.96667	3.6313	4.3020
Working environment factor UK	19.645	19	.000	3.35000	2.9931	3.7069
ERP Culture factor UK	26.045	19	.000	3.80000	3.4946	4.1054
ERP Motivational factor UK	33.108	19	.000	3.75000	3.5129	3.9871

Table 4.26 T-test result for UAE SMEs- one-sample test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Management leadership UAE	31.119	19	.000	3.78333	3.5289	4.0378
Employee involvement UAE	37.985	19	.000	3.05000	2.8819	3.2181
Training and Education UAE	24.211	19	.000	2.97500	2.7178	3.2322
Production planning UAE	42.317	19	.000	3.15000	2.9942	3.3058
Production Monitoring UAE	33.764	19	.000	3.00000	2.8140	3.1860
Production Control UAE	27.568	19	.000	3.00000	2.7722	3.2278
Reliability UAE	46.328	19	.000	3.51250	3.3538	3.6712
Barriers UAE	47.943	19	.000	2.55000	2.4387	2.6613
Organization ability UAE	38.477	19	.000	3.10000	2.9314	3.2686
Work Environment UAE	13.709	19	.000	2.82500	2.3937	3.2563
ERP Culture Factor UAE	35.693	19	.000	3.75000	3.5301	3.9699
ERP Motivation Factor UAE	48.347	19	.000	3.53750	3.3844	3.6906

It's important to note that the p value of 0.000 is 2-tailed. This means that the p value consists of a 1% chance for finding a difference. From table 4.25 and 4.26, it is inferred that there is no difference between sample mean and population mean.

4.4 Paired T-test analysis

Paired t test is used to compare the mean scores for the same group of samples on two different occasions, or when matched pairs are available.

$$t = \frac{\overline{X1} - \overline{X2}}{S} * \sqrt{\frac{n1n2}{n1 + n2}}$$

$\overline{X1}$ - mean of the first sample

$\overline{X2}$ - mean of the second sample

S - combined standard deviation

n1- number of observations in the first sample

n2- number of observations in the second sample

Paired t-test between pre and post-employment score were performed in this analysis.

H_0: There is no association between UK and UAE SMEs' cloud ERP implementation parameters.

H_1: There is association between UK and UAE SMES cloud ERP implementation parameters.

Three parametric factors were compared with UK and UAE SMEs data analysis were calculated and the following observations were identified:

a) *Management leadership in UK and UAE pair*

Null hypothesis is accepted and there is no significance and association of management leadership score in UK and UAE.

b) *Education and training, employee involvement in UK and UAE pair*
c) *Null hypothesis is rejected and there is significance and association of education and training score, employee involvement score in UK and UAE.*

4.5 Karl Pearson coefficient of correlation

Karl Pearson coefficient of correlation is defined as:

$$\boldsymbol{r} = \frac{\sum \boldsymbol{xy}}{\sqrt{\sum \boldsymbol{x}^2 \sum \boldsymbol{y}^2}}$$

Where $\boldsymbol{x} = (\boldsymbol{X} - \overline{\boldsymbol{X}})$ and $\boldsymbol{y} = (\boldsymbol{Y} - \overline{\boldsymbol{Y}})$, deviations of X and Y series from the mean

Karl Pearson coefficient of correlation method is applied where deviation of items is taken from actual means and not from assumed means. Coefficient of correlation describes not only the magnitude of correlation but also its direction. It is used for describing the degree of correlation between two series.

4.5.1 Conceptual model of ERP implementation success propositions (P) and hypotheses (H)

The statistical model considered in this study examines relationships between cloud ERP implementation success factors (the dependent variable) and seven variables: 1) management leadership 2) employee involvement 3) training and education, 4) organizational ability 5) working environment 6) cultural factor and 7) motivational factor.

SPSS software was used to analyse the response of the study. Pearson correlation was used to analyses correlation among the seven variables. The analysis provided the information about the variables i.e whether they tend to vary together or not. The results of the correlation analysis of the variables are shown in the appendix.

4.5.2 Correlation result for UAE manufacturing SMEs

ERP cloud success factor measures: negatively and significantly correlated with organization's ability and training and education.

As shown in the appendix II, there is significant correlation (at p<0.001 level) between organization's ability, training and education, management commitment and culture factor and ERP cloud implementation success. This confirms that the hypothesis is supported.

4.5.3 Correlation result for UK manufacturing SMEs

*ERP cloud success factor measures: positively and significantly correlated with cultural factor and motivational factor***.**

As seen in the appendix A3, there is significant correlation (at p<0.001 level) between cultural and motivational factors and ERP cloud implementation success. This means the hypothesis is supported.

ERP cloud success factor measures: negatively and significantly correlated with training and education.

As highlighted in appendix II, there is significant correlation (at the p<0.001 level) between education and training and ERP cloud implementation success. This means that hypothesis is supported. Other factors in the hypothesis are not supported. The summary of the correlation result is shown in Table 4.27.

Table 4.27 Summary of the correlation result for UAE and UK SMEs

Hypothesis	UAE SMEs	UK SMEs
Management commitment	Yes	No
Employee involvement	No	No
Training and education	Yes	Yes
Organization ability	Yes	No
Working environment	No	No
Cultural factor	Yes	Yes
Motivational factor	No	Yes

From the analysis, it can be concluded that training and education factors and cultural factors, support the hypothesis in UK and UAE SMEs.

4.6 Balance score card comparison between UAE and UK SMEs

A balanced scorecard can be defined as a planning and management system that is commonly used by organizations to monitor or assess the performance against the global goals. Balanced scorecard is used as a simple performance measurement framework to a full strategic planning and management system.

Balanced scorecard method for ERP performance system was successfully carried out in UAE and UK SMEs and evaluated the overall performance of the system.

4.6.1 Balanced scorecard implementation

This perspective was divided into seven matrices, enabling better classification of the questions. These seven matrices consist of questions and processes and followed the sequence as shown below:

Step 1:

- Calculate average response score of UK SMEs matrix
- Calculated average response score of UAE SMEs matrix

Step 2:

- Calculate average weightage of the matrix: 5 (because Likert five-point scale was used in the analysis)

Step 3:

- Calculate average response score matrix /weight age of matrix, using the above formula.

Step 4:

Since there were seven matrixes in this perspective, which had a mean weightage of 0.143 (1/7).

Performance of the first factor = Score of matrix * mean weight age

Step 5:

Overall implementation of success performance of SMEs was calculated by using the formula,

∑ Score of matrix * mean weight age and it is presented in the appendix A3.

Step 6:

Evaluation criteria

The following scale was used to measure the performance of the proposed system.

Point	Scale
Excellent	0.81 – 1
Good	0.61 - 0.8
Fair	0.51 - 0.6
Poor	0 – 0.5

From appendix A5, it is noted that performance balanced score card for both UK and UAE SMEs in overall implementation of success performance score is between 0.61-0.8. This falls under the category of GOOD ranking in the standard scale.

4.8 Mathematical model

A mathematical model was generated for 20 samples separately for SMEs in UK and UAE. Because it was difficult to obtain clearer results, the modelling was carried out as a whole with 40 samples. Analysis of Karl Pearson coefficient of correlation result is presented in Table 4.34.

Table 4.34 Karl Pearson coefficient of correlation for manufacturing SMEs

Dependent Variable	Independent Variable	Sample size (N)	Pearson correlation coefficient	Significance for 2 tailed test	Result
ERP Implementation Success	Management Leadership	40	-0.314	0.049	Significant
ERP Implementation Success	Employee Involvement	40	0.191	0.239	insignificant
ERP Implementation Success	Training and Education	40	-0.347	0.028	Significant
ERP Implementation Success	Organization ability	40	-0.011	0.946	insignificant
ERP Implementation Success	Working Environment	40	0.220	0.172	insignificant
ERP Implementation Success	Cultural Factor	40	0.109	0.503	insignificant
ERP Implementation Success	Motivation Factor	40	0.400	0.011	Significant

From Table 4.34, it is noted that correlation between ERP implementation success and management leadership, training and education and motivational factors were seen to be significant.

4.8.1 Multiple regression analysis

Regression analysis is a statistical procedure for analysing the relationship between a metric dependent variable and one or more independent variables. Multiple regression technique also develops mathematical relationship between two or more independent variables and an interval-scaled dependent variable (Kazmier, 2005).

***Multiple regression** model* is an equation used to explain the results of multiple regression analysis.

The general multiple regression model is as follows:

$Y = A + B_1 X_1 + B_2 X_2 + B_3 X_3 + \dots + B_n X_n$

Where A represents the intercept and B_1, B_2 B_3.........................B_n represents partial regression coefficients.

The partial regression coefficient B_1 denotes the change in the predicted value Y per unit change in X_1 when the other independent variables from X_2 to X_n are held constant. B_1, B_2.........B_n is also referred as non-standardised regression coefficient (Julie Pallant, 2013).

Standard regression coefficient is also termed as beta coefficient or beta weight is the slope obtained by the regression of Y on $\bar{X}$ when the data are standardised. The strength of association in multiple regressions is measured by the square of the multiple correlation coefficients (R^2) which is also called as the coefficient of multiple determination. R-square (R^2) is a statistic that measures the percentage of variation in the dependent variable that is accounted for by all the explanatory variables. R^2 provides a measure of the overall goodness-of-fit of the multiple regression equation. Its value ranges from 0 to 1. Adjusted R Square (R^2), coefficient of multiple determinations is adjusted for the number of independent variables and the sample size to account for diminishing returns (Kazmier, 2005). Standard deviation of the sampling distribution is called the standard error.Standard error of estimate is the standard deviation of the actual Y values from the predicted Y values. The distance of all the points from the regression line are squared and added together to arrive at the sum of squared errors.

Degrees of freedom are the number of classes to which the values can be assigned arbitrarily without violating the restrictions or limitations placed.

F test is used to test the null hypothesis that the coefficient multiple determination in the population is zero.

Multi collinearity is a phenomenon in which one predictor variable in a multiple regression model can be linearly predicted from the others with a substantial degree of accuracy. Multi collinearity can be detected using correlation matrix before fitting the model. If two independent variables to be included in the model have a statistically significant linear correlation, they are likely to cause multi collinearity problems. A variance inflation factor is also used to detect the problem of multi collinearity. The variance inflation factor (VIF) allows a quick measure of how much a variable is contributing to the standard error in the fitted regression model (Pallant, 2013). When significant multi collinearity issues exist, the variance inflation factor will be very large for the variables involved. VIF of 10 and above indicates a multi co linearity problem

Tolerance is an indicator of how the range of variability of the specified independent that is not explained by other independent variables in the model Tolerance is calculated using the formula 1-R^2 for each variable. If this value is very small (less than 0.10), it indicates that the multi correlation with other variables is high, suggesting the possibility of multi collinearity.

4.8.1 Multiple regression analysis for manufacturing SMEs

In this analysis, multiple regression analysis was performed using ERP implementation success as a dependent variable and management leadership, training and education and motivational factors as the independent variables. Table 4.35 shows the summary of the regression results. The model constitutes the following form:

ERP implementation success = f (management leadership, training and education and motivational factors)

Table 4.35 Model summary for regression Result

Model	R		R square				Adjusted R square	Std. error of estimate
1	.587[a]		.344				.289	.91056

a. Predictors: (constant), management leadership, ERP motivational factor, training and education

b. Dependent variable: ERP implementation success

Coefficients[a]

Model		Unstandardized coefficients		Standardized coefficients		
		B	Std. Error	Beta	**t**	**Sig.**
1	(Constant)	2.550	1.697		1.503	.142
	ERP motivational factor	1.041	.338	.419	3.075	.004
	Training and education	-.456	.194	-.332	-2.345	.025
	Management leadership	-.410	.295	-.196	-1.392	.173

ANOVA[b]

Model		**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
1	Regression	15.652	3	5.217	6.293	.002[a]
	Residual	29.848	36	.829		
	Total	45.500	39			

From Table 4.35, it is evident that management leadership is not significant in explaining the variation in ERP implementation success. Reduced regression was developed in this analysis that excluded the variables. Table 4.36 shows the summary of the results of reduced regression model.

ERP implementation success = f (training and education and motivational factors).

Table 4.36 Summary of result of regression for reduced model

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.556[a]	.309	.271	.92201

a. Predictors: (constant), ERP motivational factor, training and education

ANOVA[b]

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	14.046	2	7.023	8.262	.001[a]
	Residual	31.454	37	.850		
	Total	45.500	39			

Model		Unstandardized coefficients		Standardized coefficients	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	1.089	1.350		.807	.425
	Training and education	-.533	.189	-.388	-2.825	.008
	ERP motivational factor	1.083	.341	.436	3.173	.003

Model		Collinearity Statistics	
		tolerance	VIF
1	(Constant)		
	Training and education	.991	1.009
	ERP motivational factor	.991	1.009

ERP implementation success = -0.533 (training and education) + 1.083 (motivational factor) + 1.089……………… (1)

There is a positive relationship between ERP implementation success and motivational factors as the regression coefficient are 1.081. Mathematically, it means ERP implementation success will increase 1.081 % if motivational factor increases by 1% without change of all other predictors (Cao et al., 2006). Analysis shows a negative relationship between ERP implementation success and training and education as the regression coefficient is -0.533.

4.8.2 Model validation between factors and ERP implementation Success

The regression model explains the variation accounts for 30.9 percent (R square 0.309) of the total variation. The R^2 associated with the model is 0.237. This implies that the two independent (predictors) variables explain 30.9% of the variation in pre-employment score.

The F ratio was significant at the 0.000 level, which means that the results of the regression models could hardly have occurred by chance (Chacker and Jabnoun, 2003).

Results for tolerance also indicate that there is no multi-collinearity since there is no value less than 0.10.

Significant multi collinearity issues exist; when the variance inflation factor will be very large for the variables involved. A VIF of 10 or above indicates a multi collinearity problem. In this analysis, collinearity statistics between ERP implementation success and factors shows a variance inflation factor (VIF) less than 10. Hence, there is no evidence of multi collinearity.

P-P plot (probability-probability plot) between the standardized residuals and dependent variable as ERP implementation success implies that there is a linear relationship exists between dependent and independent variables as shown in Figure 4.18.

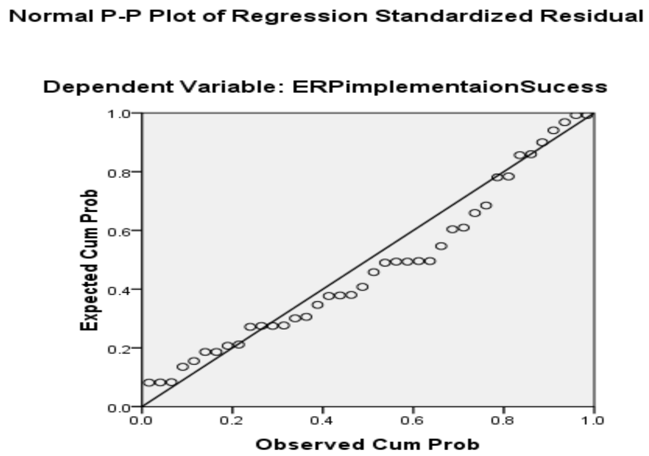


Figure 4.18 P-P plot for manufacturing SMEs

The quality of the regression can also be assessed from a plot of residuals versus the predicted values as shown in Figure 4.19. The plot shows no observable structure, hence indicates that the model is accurate and acceptable.

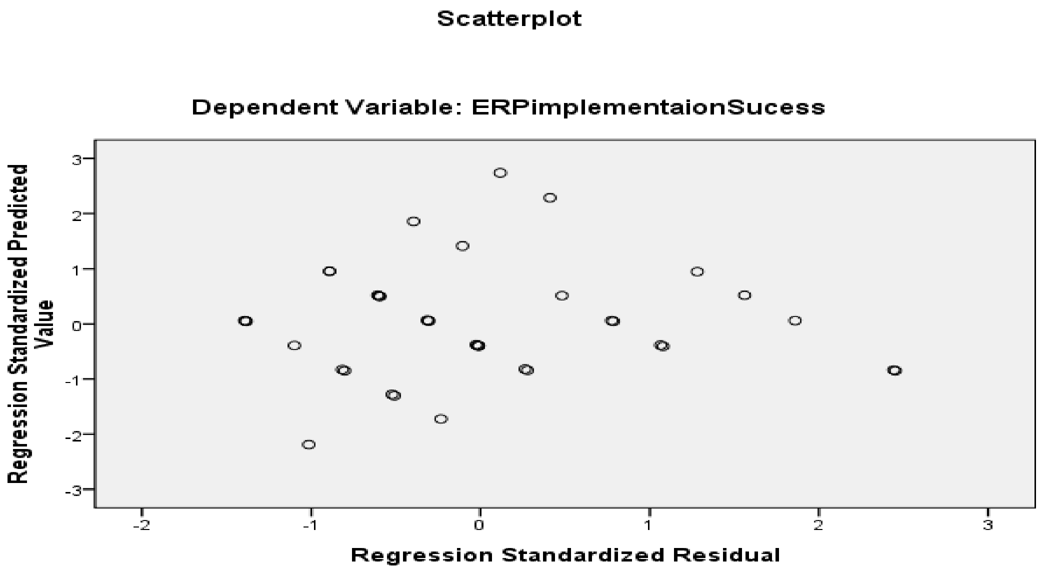


Figure 4.19 Predicted versus residual for manufacturing SMEs

4.9 Results and discussion

Internal consistency of the data surveyed through Cronbach's Alpha for UAE manufacturing SMEs is 0.698 and 0.536 for UK SMEs. This indicates a high level of internal consistency for author’s scale with this specific sample. The majority of survey participants from UK and UAE SMEs have less than 100 employees. Although the employees are less in number, the SMEs are willing to implement cloud ERP. Unlike UAE, ERP cloud services are widely used for inventory control and supply chain management activities in UK SMEs. Both UAE and UK, companies prefer resource implication for cloud services through training and materials. The major challenge prior to ERP cloud implementation in both countries was identified as inefficient project team. In UAE companies, resistance to change was found to be an additional major challenge.

The major issues during ERP cloud implementation in UK SMEs were high cost and wrong perception of benefits of cloud based ERP. Whereas the main issues in incorporation of ERP were found to be lack of financial support and awareness of up-to-date tools and techniques in the manufacturing functions and IT knowledge. The selection of ERP cloud vendor was purely based on reputation, in both nations. Both in UK and UAE SMEs, participants viewed success factors for cloud based ERP as management leadership, employee involvement, training and education, organizational ability, working environment, cultural and motivational factors. In considering adoption of cloud based ERP were driven by the influence of management decisions and cultural factors in both UK and UAE SMEs.

Results of t-test one for ERP cloud success implementation factors indicate that there was no significant difference between sample mean and population mean.

Analysis of paired t-test in management leadership, employee involvement and education and training showed that the leadership culture in management has no significance in SMEs in both UK and UAE. This is very obvious since the leadership culture differs from UK and UAE executives. The employee involvement, education and training have significance relationship which indicates that mind set of the employees in both UK and UAE manufacturing SME s was similar.

The correlation test for the success factors for UK SMEs indicates that cultural and motivational factor shows positive correlation for ERP cloud success. But this contradicts with UAE SMEs as organizational ability, training and education, cultural factors and management leadership show negative correlation for success of cloud ERP implementation. The overall performance for ERP cloud implementation success was calculated using balance score card method and the result was found to be 0.658 for UAE and 0.742 for UK SMEs. This falls under GOOD category. Analysis also indicates that the ERP Implementation success for UK SMEs is highly influenced by cultural and motivational factors. Whereas ERP implementation success in UAE SMEs was highly influenced by cultural factors and working environment. Multiple regression analysis indicates that motivational factors were the major influencing parameters for the success of cloud based ERP implementation. One unexpected finding in the empirical analysis is that education and training has negative influence on the success implementation of cloud ERP.

4.10 Comparative study of the results with other research other research

Garg and Agarwal (2014) identified that culture and motivational factors were considered important factors in their regression model formulated for their study.

Their mathematical model for ERP implementation success using multiple regression model showed similar results as seen in this research. Garg an Agarwal's study showed positive correlation with top management commitment, user involvement, business process reengineering, project management and ERP teamwork and composition parameters with ERP implementation success. Based on the multiple regression analysis, the researchers found that ERP teamwork and composition parameters was the major influencing factor in the ERP implementation system. This is quite similar to the results found in the analysis.

Tripti and Mahara (2013) through their regression model, identified that possible benefits and threats based on the three enterprise perspectives i.e. economical, technological and people that a SME will encounter while evaluating success in implementing cloud ERP system. Their study was conducted in SMEs in the developing countries. Their results indicated that economical perspective was the major benefit that SMEs perceive for adoption of cloud based ERP system whereas the major threat would include the technological issues like data backup, security and availability.

Supramaniam (2010) discussed the critical success factors in ERP implementation in Malaysian SMEs and highlighted the benefits achieved from the ERP implementation. One-sample t-test was conducted on the means of the skill and channel variables to identify the correlation with the variables. The author identified three attributes for the success of cloud ERP implementation i.e. knowledge representatives, technical knowledge management, business process, project team and communication. Research by Kan and Yushu (2004), highlighted that interpersonal quality was an important criterion in ERP cloud implementation.

Kanio et al (2015) employed a survey research design and a multinomial ordinal logistic regression analysis to establish users' perception on the effectiveness of ERP system in enhancing the performance of the accounting information system (AIS) through reliability, accuracy and timeliness of information generated. Their study concluded that implementation of an ERP system is an opportunity to implement improved controls and security of data which enhances reliability. hence performance of accounting information. The fact that technological factor is important in the ERP cloud implementation. However, this research is yet to investigate this finding.

4.11 Identification of critical success factors for cloud based manufacturing ERP implementation

Due to the complex nature of ERP system, the implementation process involves large number of factors and conditions. Study carried out by Mabert et al., (2000) shows that many companies suffered failure in achieving maximum benefit in the ERP implementation projects. In order to ensure the realisation of promised benefits and to prevent possible disappointments, it is important to identify the critical success factors (CSF) for cloud based ERP implementation. From the empirical analysis a number of CSFs have been identified as the essential elements for cloud based ERP implementation in UAE SMEs. These CSFs are summarised in Table 4.37.

Table 4.37 Critical success factors for cloud based ERP implementation

• Top management support	• Data analysis and conversion
• Project champion	• Business process re-engineering
• User training and education	• Defining he architecture
• Management of expectation	• Dedicated resources
• Vendor/customer partnership	• Project team competence
• Use of vendors' development tools (database management /data warehouse/ information management tools	• Change management
• Careful selection of the appropriate package	• Clear goals and objectives
• Project management	• Education about new business processes
• Steering committee	• Interdepartmental communication
• Use of consultants	• Inter departmental co-operation
• Minimal customisation	• Ongoing vendor support

CHAPTER 5
MODEL DEVELOPMENT

5.1 Introduction

This chapter discusses the development of the conceptual framework for cloud-based manufacturing ERP (CBMERP). The proposed model emphasizes primarily on manufacturing modules in an ERP software that is more suited for UAE SMEs.

5.2 Need for cloud based ERP in manufacturing SMEs

The key drivers motivating SMEs to adopt cloud ERP are: a) increasing growth in small business sector and b) more ERP software vendors are focusing on the small business organizations. As highlighted in chapter 1, many UAE manufacturing SMEs are considering implementing cloud ERP systems in their businesses because of the need to sustain competitive advantage and coping with international legacy systems (Karchur, 2013). The key reasons motivating SMEs to adopt cloud based ERP are: a) growth of the small business sector, and b) more focus on the small business market from ERP software vendors. Other reason is there are many ERP vendors are able to provide the customized cloud ERP solutions to clients' specific business needs.

Although widespread focus on SMEs is good for small companies with restricted capital budgets, there are some risks. Because of the availability of more choices nowadays, UAE SMEs must be careful in selecting and evaluating a cloud ERP software package. Vendor selection process must ensure the worthy of cloud ERP software package and return on investment is justified. Although there many benefits in implementing cloud ERP, it can incur huge cost to SMEs.

5.3 ERP system for SMEs

ERP was a term restricted purely to large organizations. Large organizations adopted ERP process regardless of the consequences. But ERP for SMEs remained a mere misconception. Due to availability of more ERP vendors nowadays, many SMEs show more interest and willingness to implement ERP systems. This has further extended to the application of cloud-based ERP system to gain any competitive advantage. Because, there is a growing awareness of cloud ERP in SMEs, ERP vendors pay more focus on small and medium companies.

Manufacturing organizations immensely benefit from using a robust ERP solution that is integrated into their operations. It helps the companies to be more efficient, thereby reducing costs and enhancing the overall quality. This leads to better customer satisfaction and increase in revenue. As companies grow, many operating procedures require amendments to contain the expansion. If they are not addressed timely, then it leads to inefficiencies and discrepancies. When an organization is incapable to meet the expectations, it leads to customer dissatisfaction, bad reputation and loss of revenue. It is advocated that, manufacturing companies should follow the efficient ERP modules and parameters to ensure that they are selecting an agile platform that can satisfy the ever changing needs of manufacturing businesses.

5.4 Role of ERP in SMEs

As the ERP system market has begun to saturate, ERP developers are shifting their focus from large organization to SMEs. The vendors are increasingly developing software that serves the requirements of SMEs such as comparatively less complexity, minimal customization and most importantly, a lower cost system. Meanwhile, in response to increasing competitions, SMEs need to improve efficiency and pressure from partners in their supply chain are themselves beginning to realize the significance of ERP system. There is an increasing awareness and positive perception by SMEs on the potential benefits accruable from adopting ERP implementation. However, due to their relatively limited resources and lack of IT infrastructure or experience, SMEs faces a significant challenge in implementing new ERP systems successfully.

Further, it seems likely that SMEs, due to their more limited resources and more fragile market share, cannot afford to absorb a failed ERP implementation in the same way in which a larger organization might. Generally, they do not have the finances to recover from a failed implementation. A failed implementation can have disastrous implications including loss of market share and could even lead bankruptcy. Nevertheless, despite the higher stakes involved, there is limited research on how to assist SMEs implementing ERP system and overcome the complexities.

5.5 Overview of CBMERP

Taking these issues discussed in section 5.3 and 5.4 into consideration, the proposed model (CBMERP) envelops many attributes in the design. A conceptual framework developed in this study is shown in Figure. 5.1 and the flow diagram of CBMERP is shown in Figure 5.2.

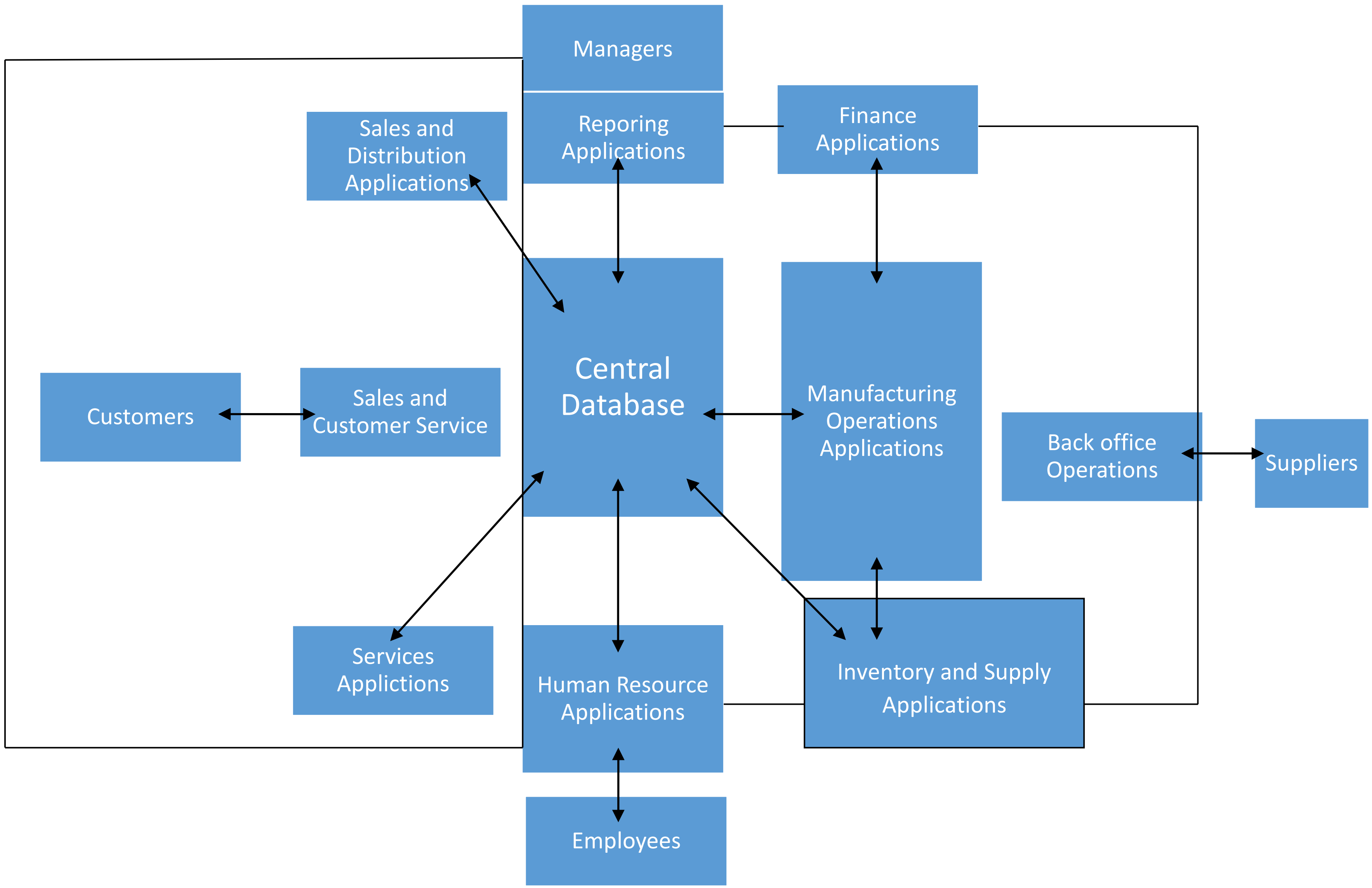


Figure 5.1 Conceptual Model of CBMERP

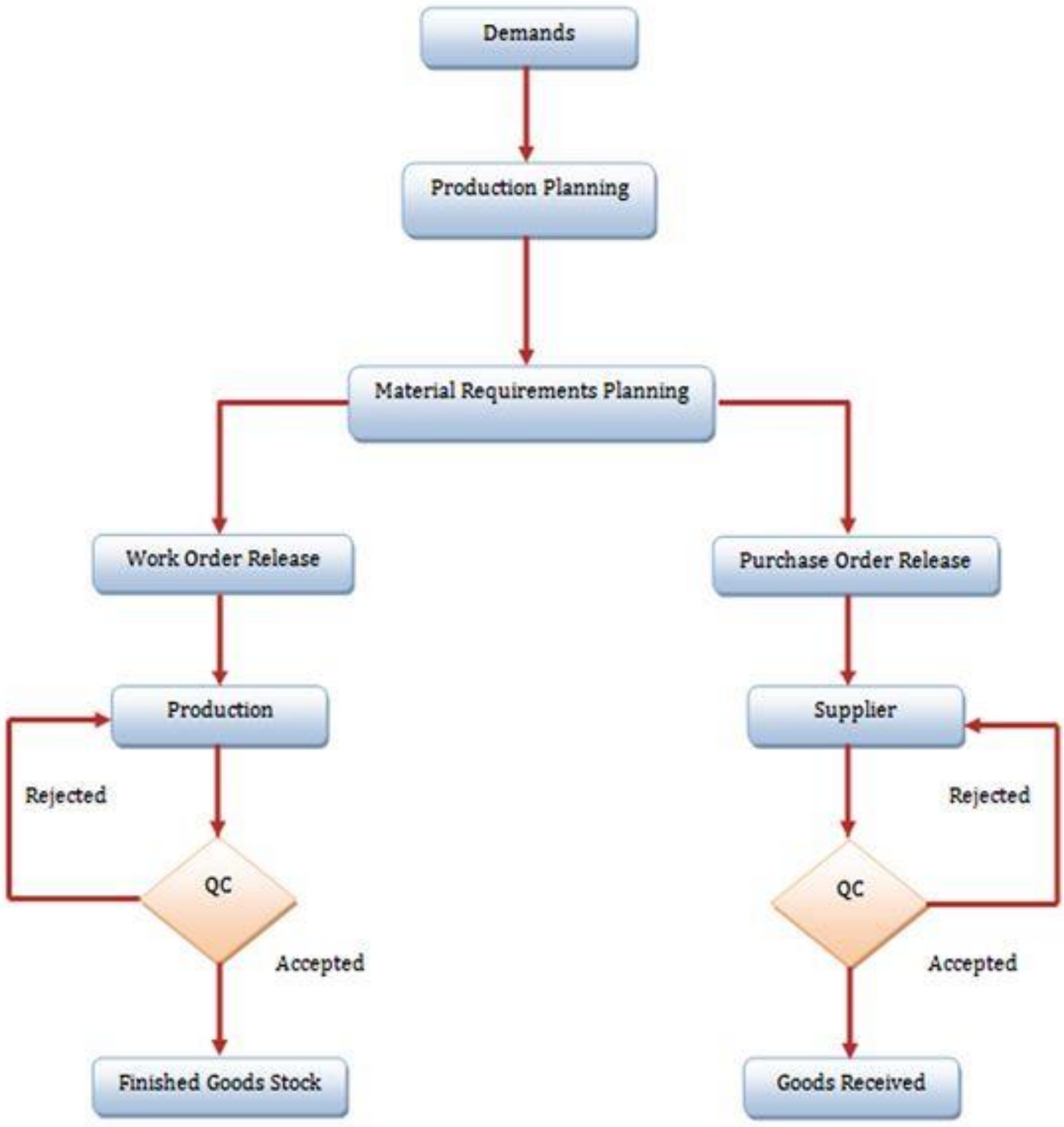


Figure 5.2 Flow Diagram of CBMERP

ERP software comes with different characteristics and more customised to fit individual needs of the company. Therefore, vendors with specific knowledge in cloud ERP system, particularly, manufacturing modules considered in the design of CBMERP. The following section discusses the main features designed in the CBMERP.

5.5.2 Unified integration with software

CBMERP model is designed carefully to function easily with existing systems and easy to analyse time and money being invested towards project completion.

5.5.3 Design user friendly interfaces

An ERP software will be less attractive if it is not easily accessible to carry out daily tasks. Taking this objective into consideration, CBMERP model is designed in such that it is easy to learn and use as well as complete relevant operations. This is very important in a manufacturing environment where every projects are different from one another. The application should be easily navigable. Consideration for ease of use parameters was given more importance in the design of proposed cloud based ERP model.

5.5.4 Design accurate tools to track and monitor

Manufacturing cost was given a high priority concern in CBMERP to prevent customer dissatisfaction. Design of CBMERP also concentrated including sub-modules to enable the ERP system to track expenses, thereby giving a transparent picture of the monetary investment on a specific project. This will help manufacturers to have more control over their budgetary limits agreed by their clients.

5.6 Major modules in CBMERP

CBMERP is a module-based ERP framework. Each module automates individual department’s business functions. Thus, each business applications can be executed and organised module-by-module as shown in Figure 5.1. Because the driving force behind the success of cloud ERP is to automate and streamline organisation-wide strategic and resource planning, sub modules in CBMERP were selected carefully to provide the meaningful integration in expediting operational synchronisation across various functional departments. In selecting the modules for the proposed model, care was taken in the integration of all the modules with enterprise-wide applications.

No matter whatever product and company manufactures, manufacturers prefer their product to be unique, defect-free and produced at low cost than their competitors. To achieve these objectives, it is paramount for the manufacturer to know the capacity of their facility, maintain a production schedule, adhere to quality standards, comply with regulations and ensure the required components arrive on time and on-time delivery. CBMERP module has been designed to coordinate facilities, equipment, all types of inventories including work-in-process and also manage production operations for maximum efficiency with minimal bottleneck problems and downtime in production. Users can integrate and coordinate processes, thereby focussing on manufacturing the products better and faster.

Similar to large organizations, SMEs prefer to implement the ERP modules that suit their business requirements. CBMERP model includes many major and sub modules such as production planning module, MRP modules, material purchasing module, product distribution module, quality control module, inventory control module, finance module, order tracing module, marketing module, CRM module, HR module and accounting module (Figure.5.3).

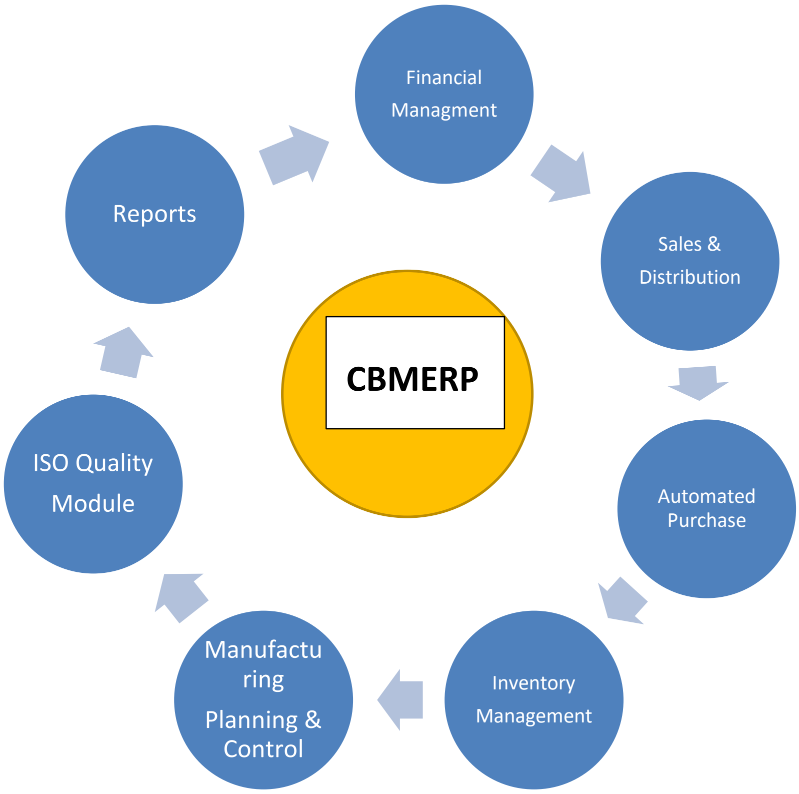


Figure 5.3 Major modules in CBMERP

From back office processing to management of resources and businesses departments, the CBMERP comprises an integrated suite of submodules where data is entered once and flows automatically and seamlessly through the ERP system. Extensive functionalities integrated in the model is shown in Figure. 5.4 and 5.5 and include:

- Materials management
- Detailed costings (actual, expected and standard)
- Warehousing and stock control
- Bills of materials, with variations and revision control (BOM)
- Full traceability
- Customer relationship management (CRM)
- Supply chain management (SCM)

- Quality control, incorporating vendor performance and reporting
- Reporting and KPI (key performance indicator) analysis
- Delivery management and tracking
- Materials requirements planning (MRP)
- Advanced planning system incorporating finite capacity scheduling (APS)

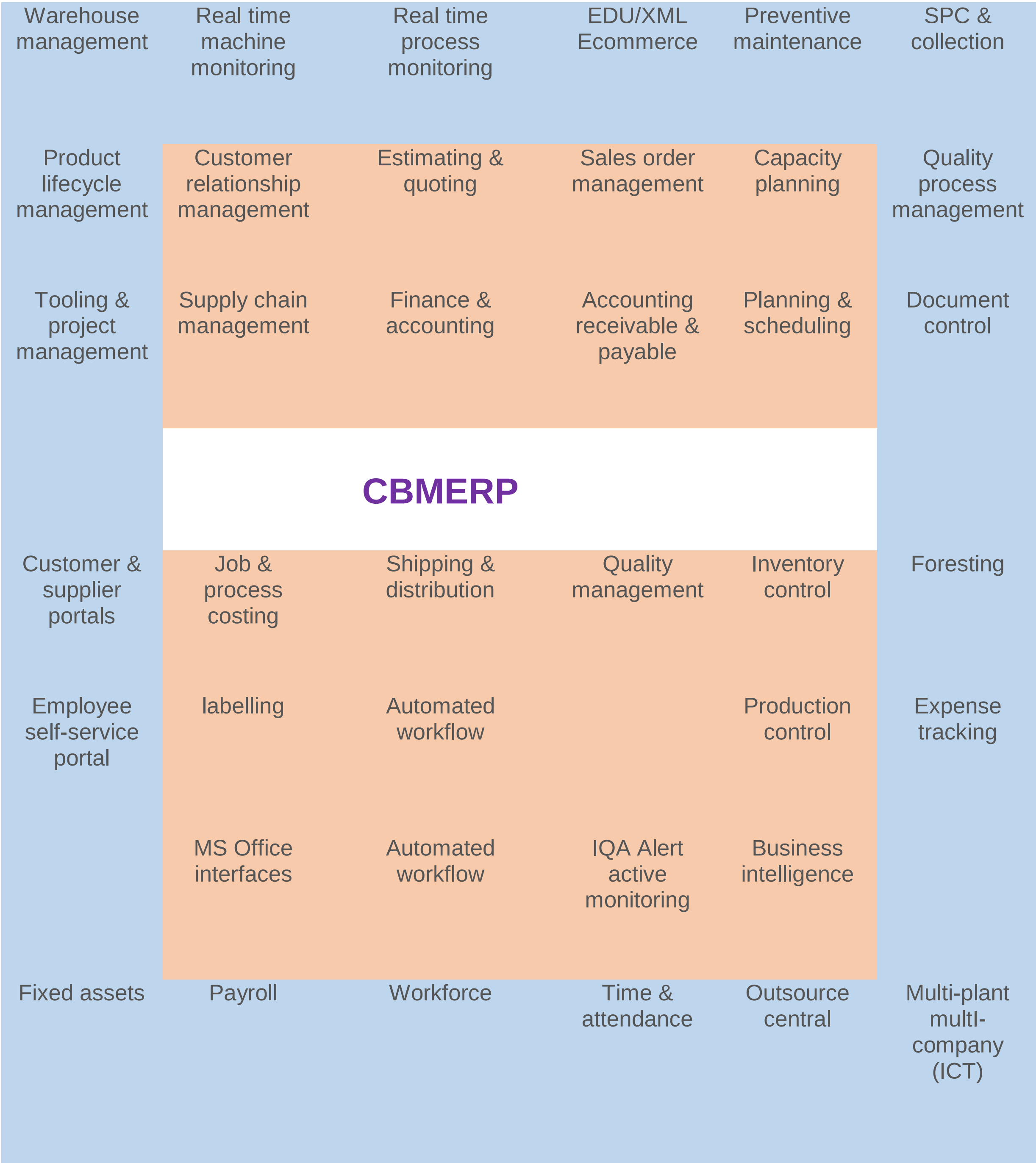


Figure 5.4 Integrated modules in CBMERP

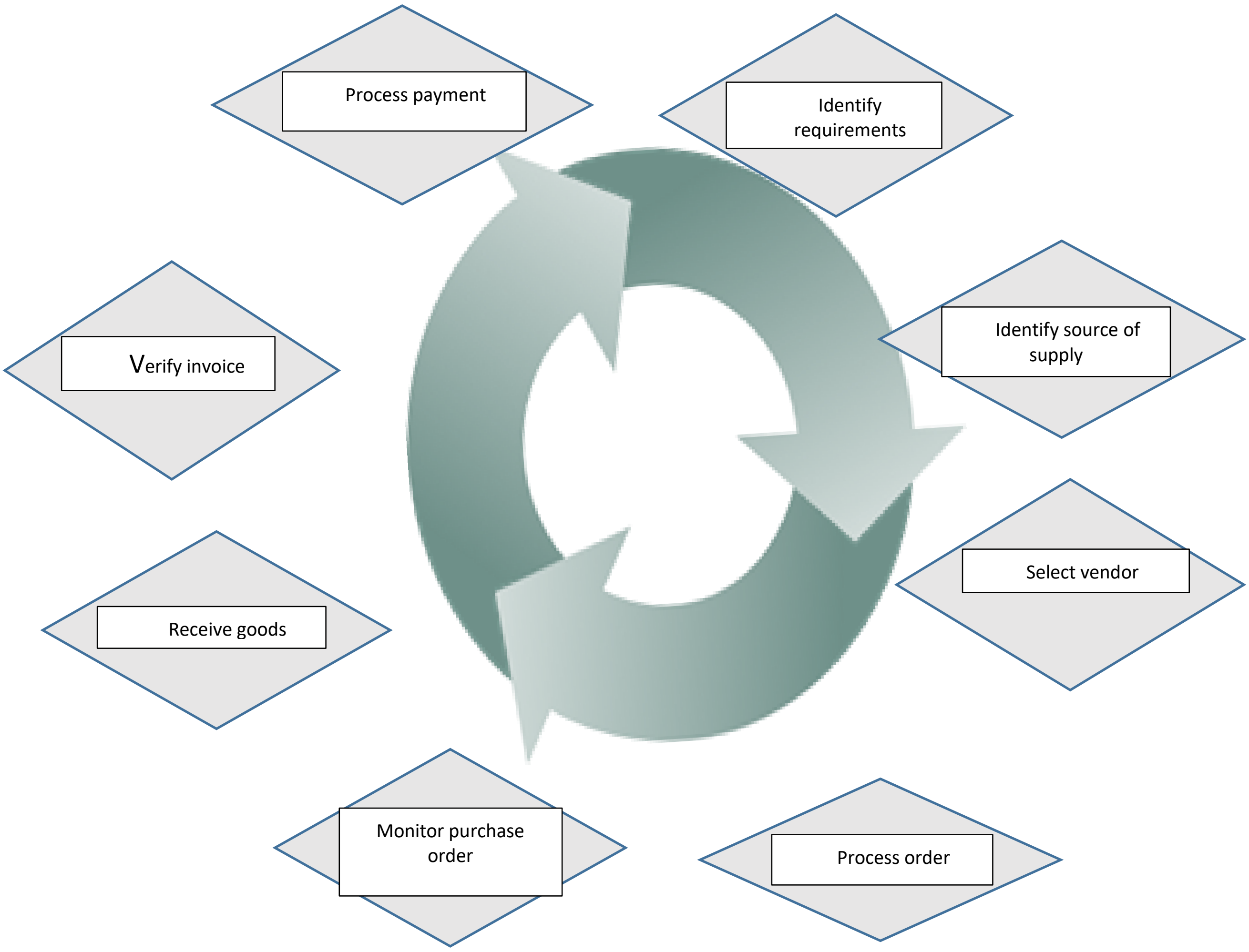


Figure 5.5 Material procurement cycle

5.7 CBMERP model description

As discussed in section 5.6, CBMERP model is made up of many primary and sub modules which mimic key functional areas of a company. Because SMEs select ERP modules that are easy to use, technically and economically feasible, modules were carefully selected and integrated in the CBMERP. The characteristics and functionalities of various major and sub-modules integrated in CBMERP are explained below in detail (Figure 5.6).

5.7.1 Purchasing module

Purchase module takes care of all the processes that are part of procurement of items or raw materials that are required for organization. Purchase module consists of functionalities like supplier/vendor listing, supplier and item linking, sending quotation request to vendors, receiving and recording quotations, analysis of quotations, preparing purchase orders, tracking the purchase items, preparing goods and receipt notes and updating stocks and various reports. Purchase module is integrated with inventory module and engineering/production module for updating of stocks. Purchase module in CBMERP streamlines procurement of raw materials that are needed for production. It automates the relevant processes to identify suppliers, price bargaining, creating purchase orders for suppliers and billing processes. Purchase module is very closely integrated with production planning, inventory control and supply chain modules.

5.7.2 Inventory control

Inventory control module in CBMERP facilitates processes to maintain safe stock levels in the warehouse. This module also undertakes responsibilities to identify and manage inventory needs, target setting, assistance in decision making in replenishment techniques and options, monitoring and controlling material usages, maintain continual report on inventory status and raise any concerns on safety stock level and reconciling the inventory balances. Inventory module can be used to track the stock of items. Items can be identified by unique serial numbers. Using that unique numbers inventory system can keep track of item and trace its current location in organization. Inventory module includes functionalities like inventory control, master units, stock utilization reporting etc. In CBMERP, inventory module is integrated with purchase module. Inventory control module is also integrated with finance, purchase, sales modules to allow

CBMERP system to produce attentive reports to assist decision making function at executive level.

5.7.8 Sales module

Typical sales process includes processes like sales queries and enquiry analysis and handling, quotation drafting, accepting sales orders, drafting sales invoices with proper taxation, dispatch, shipment of material or service, tracking pending sales order. All these sales transactions are managed by sales module. CBMERP's sales module manages generating and scheduling orders, shipping, invoicing. Sales module is carefully integrated with companies' online commerce activities.

5.7.9 Marketing module

CBMERP marketing module manages supporting, direct mailing and many more related activities.

5.7.10 Finance and accounting module

The entire inflow and outflow of capital is managed by finance module. This module keeps track of all account related transactions like expenditures, balance sheet, account ledgers, budgeting, bank statements, payment receipts and tax management. Financial reporting is easy task for this module of ERP. The financial module is the core element in the CBMERP system. It is designed to collect financial data from all the functional departments in the organisations and generate financial reports such as general ledger, balance sheet and quarterly financial accounts statements.

5.7.11 Human resources module

HR module in CBMERP manages and streamlines the HR resources. This module maintains employee database including personal and salary details, record of attendance, promotion, and training and performance evaluation of all employees. HR module helps HR team for efficient management of human resources. HR module helps to manage employee information, track employee records like performance reviews, designations, job descriptions, skill matrix, time and attendance tracking. One of the important submodule in HR module is payroll system which helps to manage salaries, payment repots etc. It can also include travel expenses and reimbursement tracking. Employee training can also be tracked and managed by CBMERP.

5.7.12 Customer relationship management (CRM) module

CRM department helps to boost the sales performance through better customer service and establishing the strong relationship with customers. All the stored details of customer are available in CRM module. CRM module helps to manage and track detailed information of the customer like communication history, calls, meetings, details of purchases made by customer, contract duration etc. CRM module is integrated with sales module to enhance sales opportunities.

5.7.13 Supply chain management (SCM) module

SCM module manages the flow of product items from manufacturer to consumer and consumer to manufacturer. Common business groups involved in this module are manufacturer, wholesalers, distributors, retailers etc. SCM involves demand and supply management, sales returns and replacing process, shipping and transportation tracking etc. Today, many SMEs face challenges in their process automation. ERP cloud is the great support for such organizations. CBMERP can efficiently streamline the business operations of organization. Modules integrated in CBMERP framework can help users select and customize the various modules depending on the individual need of a SME.

5.7.14 Production planning module (PPM)

Although many ERP software vendors has introduced MRP into their ERP packages, different types of robust modules for production planning and several unique attributes are considered in CBMERP. Production planning module in CBMERP includes many functionalities to optimize the use of production capacity, components and material resources using sales forecasting and historical manufacturing data. PPM in CBMERP provides several integrated functionalities as shown in Figure 5.6.

Sales & distribution	Inventory	procurement	Process manufacturing	Maintenance management	Project management	HR management	Finance & accounting
Sales administration	Inventory administration	Procurement administration	Manufacturing administration	Equipment induction & setup	Project administration	Workforce management	General accounting
CRM	Inventory analysis & planning	Sourcing & purchasing	Recipe management	Preventive maintenance	Bid management	Recruitment	Receivable management
Demand planning	Warehouse management	Inbound logistics	Continuous production	Predictive maintenance	Project definition	Talent management	Payable management
Order management	Quality management	subcontracting	planning	Shutdown/outage management	Project planning	Employee development	Fixed asset management
Outbound logistics	Physical inventory & cycle counting	imports	Production order management	Work management	project execution	Payroll & benefits	Global tax solution
Exports		Supplier portal	scheduling	Reliability & review	Billing	Planning	Financial services
After sales service			Manufacturing execution		Project closure		Management accounting
Dealer management			Costing				
Customer portal			Quality management				
			New product development				
	Advance reporting		Wizard interface	Embedded workflow		**Data uploads**	

Figure 5.6 CBMERP process manufacturing

The manufacturing activities included in CBMERP are grouped in three production planning processes as outlined below:

5.7.15 Production planning process 1

- Production by lot size to responsive to customer need i.e. reduce inventory level and change production runs
- Processing work orders
- Sales and planning manufacturing operations
- Managing demand and organise production schedule
- Integrates customer demand
- Planning master production schedule
- Capacity requirement planning
- Develop detailed material plan in line with MRP
- Transfer to procurement / stock transfer
- Release work orders to manufacturing plant:
    - materials
    - operations
    - quality control process
    - costing

5.7.16 Production planning process 2

- Repetitive on continuous manufacturing
- High volume or mass production
- Use production schedules such as make-to-stock instead of work orders
- Make-to-buy or make-to-order
- Plan and track the actual cost of production

5.7.17 Production planning process 3

- Integrates manufacturing functions with business processes
- Integrate manufacturing with supply chain
- Differentiate and manages capacity-based planning and material based planning
- Responsibility for quality management for items produced in house and incoming goods such as raw material purchased from external supplier
- Type of inspection criteria to be used
- Material that flows out of production is recorded as goods receipt
- Work-in-progress status report and inventory control
- Scheduling problems
- Master data:
  - Description of business process (materials, labour, automation)
  - Develop realistic master data (e.g. shop floor practice)
  - Demand management (coping with changes in customer orders)
  - Involves determining quantities and dates for finished products / assemblies
  - Develop planned independent requirements
  - Planning for future requirements
  - Production plan using manual data
  - Forecast data
  - Scheduling
  - Develop more realistic and achievable production
- Material resource planning (MRP):
  - Starts with BOM
  - Schedules procurement and production tasks

- MPS applied initially to BOM with the highest level
- Easier to develop rough schedules for production of high value materials

- MPS run
  - Outputs
  - Amend existing plans and develop new plans
  - Generate purchase requirements
  - Delivery schedules for procured items received externally
  - Supply chain
- MRP
  - MRP governs the material type and quantity needed for production
  - It generates proposals for work order
  - MRP runs for each level in the BOM
  - Normally runs on individual materials
  - Change existing plans and develop new plans
  - Generate purchase requests
- Plant maintenance
  - Uses preventive maintenance actions; eliminate reactive repair strategy
  - Reduce costs in areas such as unnecessary surplus capacity, excessive inventory, work-in-progress
  - Optimise production operations to minimise downtime and bottleneck problems
  - Insure safety regulations
  - Develop maintenance plans

5.7.18 Business process re-engineering (BPR) module

BPR elements are considered in the proposed CBMERP. Business process reengineering is one approach for redesigning the way work is done to better support the organization's mission and reduce costs. Reengineering starts with a high level assessment of the organization's mission, strategic goals, and customer needs. An organization may find that it is operating on uncertain assumptions, particularly in terms of the customer needs. Within the framework of this basic assessment of mission and goals, reengineering focuses on the organization's business processes i.e. the steps and procedures that govern how resources are used to create products and services that meet the needs of particular customers or markets.

Various BPR elements considered in CBMERP are:

- Structural organization with functional units
- Introduction of new product development as cross-functional process
- Re-structuring and streamlining activities, removal of non-value adding activities
- Envision new processes
- Secure management support
- Identify reengineering opportunities
- Identify enabling technologies
- Align with corporate strategy
- Initiating change
- Set up reengineering team
- Outline performance goals
- Process diagnosis
- Describe existing processes
- Uncover pathologies in existing processes
- Process redesign
- Develop alternative process scenarios
- Develop new process design
- Design HR architecture
- Select IT platform
- Outline performance goals

○ Develop overall blueprint and gather feedback	○ Process monitoring
○ Performance measurement, including time, quality, cost, IT performance	○ Reconstruction
○ Develop/install IT solution	○ Link to continuous improvement
○ Establish process changes	○ Process monitoring

5.7.19 Recipe module

Recipe and batch management module helps to manage batch execution more efficiently, allocating equipment, downloading parameters and automating recipe procedures. It also coordinates everything with the plant control systems, interfaces with the operators and directs batch activity, material flow and production records to a historical database

CHAPTER 6
VALIDATION OF PROPOSED MODEL

6.0 Validation methodology

This chapter outlines the scientific approach followed to validate the proposed CBMERP model. The validation methodology involved an empirical analysis of selected SMEs. Ten manufacturing SMEs were approached to test the proposed model. These companies already have cloud computing and IT infrastructure to test the proposed model. The participating companies were already using basic ERP software with minimal manufacturing modules and functionalities integrated in the ERP systems they were using. The study was based on the views of company participants who were experts in the manufacturing operations including manufacturing engineers, supervisors, managers, quality control staffs, shop floor workers and IT workers. The validation took a shape of descriptive study and attempts to explain the improvement in the manufacturing processes with respect to different manufacturing parameters. This section also discusses the analysis of the advantages of CBMERP benefits to the manufacturing companies, in UAE in the view of professionals in ERP, manufacturing sector and managers at all levels in a manufacturing organization. For this reason, a descriptive study was followed to analyze and identify strengths, weaknesses, merits and demerits of the CBMERP through the empirical analysis as a case approach.

6.1 Variables of the study

The two types of variables were used in the study which were demographic (or personal / socio-economic) variables and research variables. The analysis used demographical and research variables. The demographical variables include job title, number of employees and total IT budget.

The analysis aimed to identify the following CBMERP benefits measure:

1. Company strategy
2. Top management support
3. Motivation
4. Challenges
5. Business process re-engineering
6. Project management
7. Employee participation
8. Reliability
9. Training of education

Satisfactory variables

These variables consist of CBMERP benefits parameters measures that provide maximum satisfaction to the workers.

Dissatisfactory variables

These variables consist of CBMERP benefits parameters that provide maximum dissatisfaction to the workers.

6.2 Pilot study

Pilot study is a formal exploratory study to find out whether there is adequate scope for research. A pilot study is a small-scale replica and a rehearsal of the main study (Saravanavel 2000). It is concerned with administrative and organizational problems related to the whole study and the respondents. A pilot study has already been conducted to know the scope of the present study among the CBMERP benefits in UAE manufacturing industry. Formal discussions and interactions with ERP professional, manufacturing professional, managers and top management people were useful to the researcher for development of the study.

6.3 Primary objective of the validation study

- To identify criteria or attributes and its inter relationship with respect to CBMERP benefits.

- To formulate the data reduction model with respect to credit CBMERP benefits through factor analysis.

- To identify significant variables influencing the CBMERP benefits through multiple regression analysis.

6.4 Limitation of the validation study

- Due to time constraint samples were limited to 100.
- The findings and suggestions were based on the facts and opinion given by the data set only.

6.5 Questionnaire development

The questionnaire was aimed at measuring the CBMERP benefits parameters and its level of importance rating. Five point Likert type scale was used to determine the levels of agreement with each statement. 100 manufacturing professionals participated in the validation survey.

6.6 Study unit of the research

Manufacturing SME having ERP systems with very basic manufacturing modules or without manufacturing modules were selected for the validation.

6.7 Target respondents

The target respondents were professionals working or responsible for the manufacturing module in ERP system in the participating company.

6.8 Sampling method

The sampling technique used in the analysis is simple random sampling. In a simple random sample (SRS) of a given size, all subsets of the frame are given an equal probability. Therefore, each element of the frame has an equal probability of selection i.e. the frame will not be subdivided or partitioned. The study depends mainly on primary data collected through well-framed structured questionnaire to obtain sound opinions of the respondents.

6.9 Method of study and analysis of variables

Analytical part of the validation study was mainly based on the primary data so that the data were put into analysis with the help of descriptive analysis i.e. termed as percentage analysis. At the outset, every variable was put into analysis as simple percentages. The percentage criteria are a commonly used tool to represent the characteristics of data. On the basis of majority or minority support arise from the workers, inferences were made initially. The study of satisfactory variables and dissatisfactory variables were based on the level of satisfaction of the workers. For this, ‘5 point Likert’s scale’ was used as follows: strongly disagree, disagree, neutral, agree and strongly agree. SPSS software was used to analyze the primary data.

6.10 Establishment of hypothesis

Hypothesis is a logical assumption whose validity is subject to testing with the help of statistical tool. The formation of suitable hypothesis is of relevance to the objectives and variables of the study. The following hypotheses were framed for the validation on the basis of the objectives and variables.

- There is significant difference between the CBMERP parameters and CBMERP benefits.
- There is significant difference between the CBMERP parameters and CBMERP benefits pairs.
- There is significant difference between the individual CBMERP parameters.
- Distribution of sample data is normal.

6.11 Data used

Primary data and secondary data were used in this research. The secondary data was collected from various secondary sources such as previous research. The primary data was collected by the researcher from the manufacturing professional in UAE's SMEs. A questionnaire was used to collect the primary data. The questionnaire consisted of three divisions; demography of the professional and expectation factors of the CBMERP benefits (9 attributes with measure variables). This is shown in appendix A2. CBMERP benefits evaluation methodology included objectives, tools and outcomes are shown in Figure 6.1.

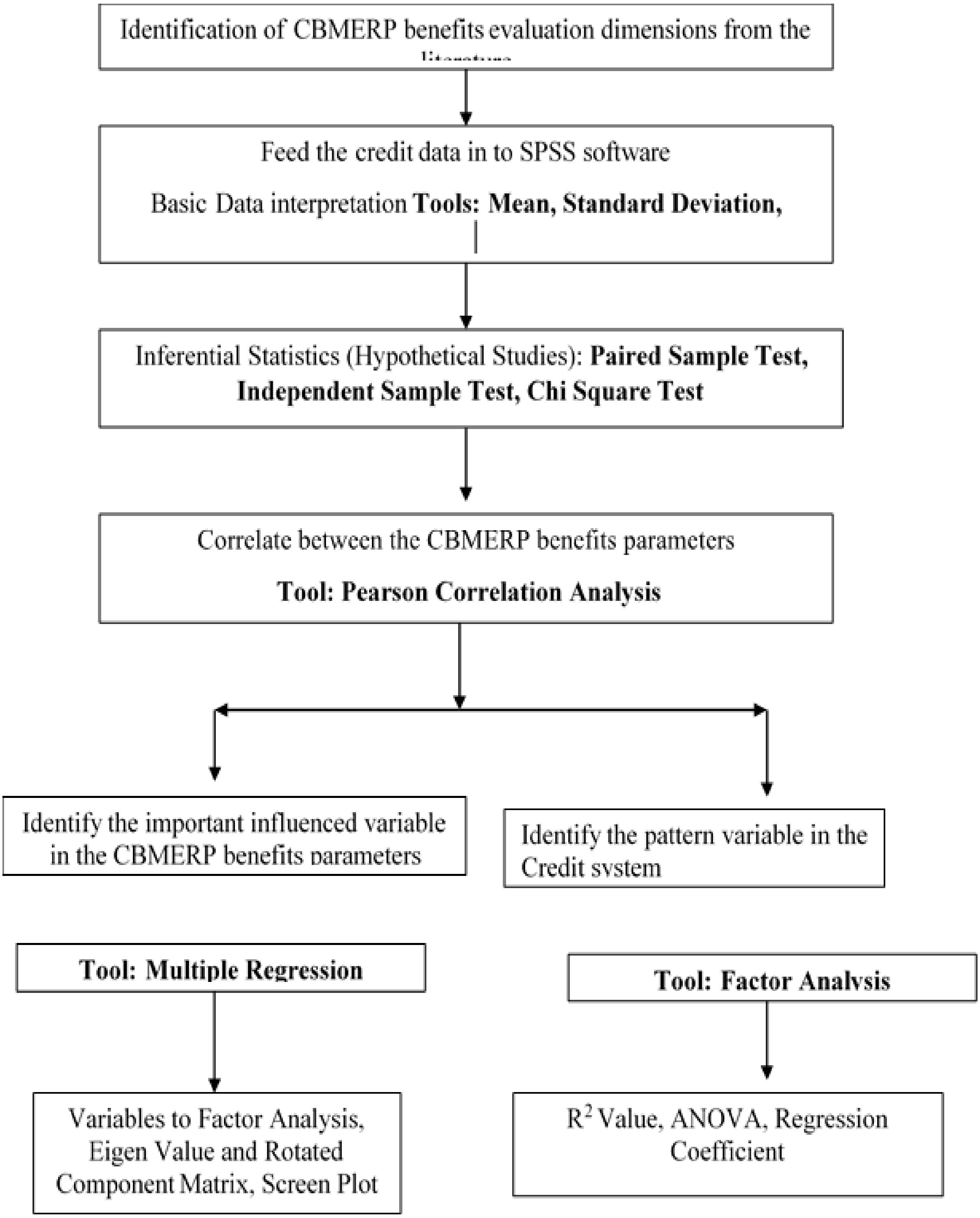


Figure 6.1: CBMERP benefits parameters evaluation methodology

A total of 100 instances were provided with different attributes with data label, measure and domain as shown in Table 6.1.

Table 6.1 Data attributes for the CBMERP system

Data Label		Measure	Data Domain
1	Job title	Ordinal	Discrete 1 - Manufacturing Engineering 2 - ERP analyst 3 - Technical Specialist 4 - Director, Manager, Supervisor 5 - System Engineering/Support 6 - Others
2	No of employees	Ordinal	Discrete 1 - Less than 100 2 - 101-200 3 - 201-400 4 - 401- above
3	IT budget	Ordinal	Discrete 1 - <0.1 M 2 - 0.11 M – 0.30 M 3 - 0.31 M – 0.40 M 4 - 0.41 M
4	Process of implementing manufacturing ERP with cloud solution	Ordinal	Discrete 1 – Yes 2 – No
5	Manufacturing area	Ordinal	Discrete 1 – Yes 2 – No
6	Critical success factors	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4 - Agree 5 -Strongly Agree
7	Parameter 1 – company strategy	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5-Strongly Agree
8	Parameter 2 – top management support	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral

			4 - Agree 5 -Strongly Agree
9	Parameter 3 – motivation with CBMERP	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5 -Strongly Agree
10	Parameter 4 - CBMERP challenges	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5 -Strongly Agree
11	Parameter 5 – Business process re-engineering	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5 -Strongly Agree
12	Parameter 6 – Project management	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5 -Strongly Agree
13	Parameter 7 – Employee participation	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5 -Strongly Agree
14	Parameter 8 – Reliability of CBMERP	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4 - Agree 5 -Strongly Agree
15	Parameter 9 – Training and education	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4- Agree 5 -Strongly Agree
16	Parameter 10 – CBMERP benefits	Nominal	Discrete 1 – Strongly Disagree 2 – Disagree 3 - Neutral 4 - Agree

6.12 Data interpretation and analysis

This section discusses the details of analysis. The analysis includes the following sub-sections and associated tools:

- Margin of error analysis
- Demographical analysis
- Descriptive statistics (mean, standard deviation, Skewness and Kurtosis, normality analysis, box plot study)
- Inferential statistics (hypothetical studies)
- Data reliability analysis (Cronbach's alpha test)
- Classification analysis (factor analysis)
- Mathematical modeling (multiple regression analysis)
- Gap analysis

6.12.1 Margin of error analysis

Antonius (2003) formulated that the following margin of error formula:

Margin of Error = Critical Value * Standard Error * Finite Population Correction Factor …. (1)

6.12.2 Critical value

The level of confident was set on 95 %. The critical value was expressed as Z score. So the critical value is 1.96.

6.12.3 Standard error

Standard Error = $\sqrt{(p^*(1-p)/n)} = 0.05$

The population size was small. Questionnaire was sent to 110 respondents and 100 responses were received. The response rate was 90. The sample proportion was set as 0.5. In the formula, where the p is sample proportion (0.5) and n is sample size (100).

6.13.4 Finite population correction factor

Standard Error = $\sqrt{(N-n)/N-1}$ = 0.301

Where,

N is population size - 110

n is sample size - 100

Critical value, standard error and finite population correction factor values were substituted in the formula (1) and the Margin of Error calculated was 2.94 %. The above margin of error reflects that the estimate for current study is not exactly equal to the statistics, but approximates 2.94% of the statistics. This is due to every sample in the population differs slightly from one another.

Demographical Analysis

6.13.1 Job title wise respondents

Table 6.1 Percentage for job title

Job Title	Frequency	Percent
Manufacturing engineer	24	24.0
ERP analyst	21	21.0
Technical support	25	25.0
Director/manager/ supervisor	7	7.0
System engineer	17	17.0
Others	6	6.0
Total	100	100.0

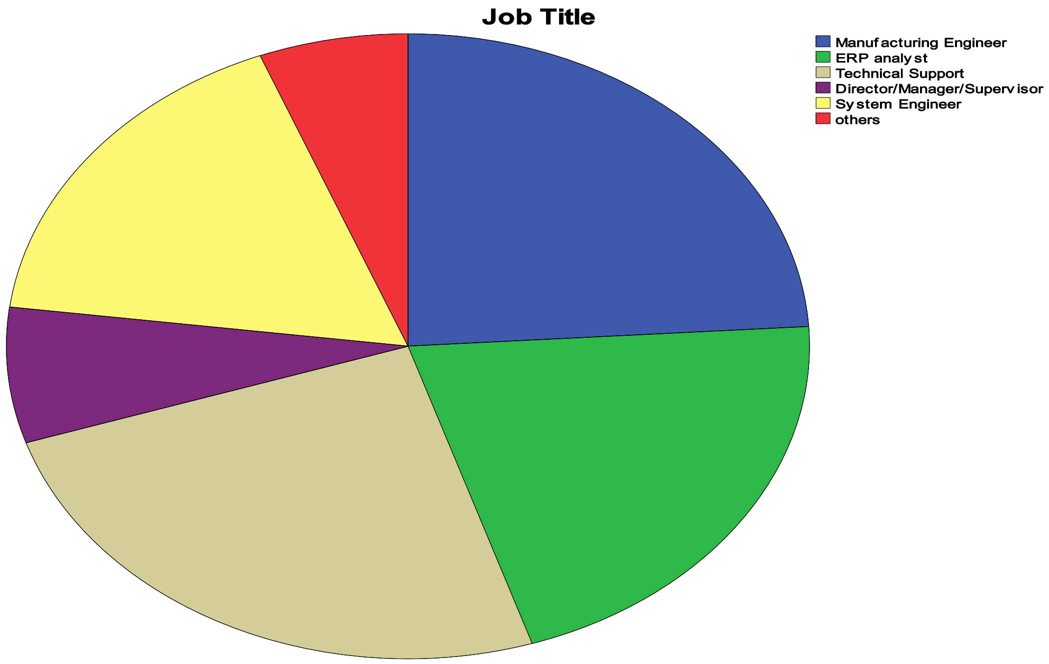


Figure 6.1 Pie chart for job title

From the Figure 6.1 and Table 6.1 it is inferred that, among the participants who took part in the validation survey, the percentage of staffs were: technical support employees - 25%, manufacturing engineers - 24%, ERP analysts - 21% and other professionals - 6%.

6.13.2 No of employee wise respondents

From the Table 6,2 and the Figure 6,2 for number of employees' distribution, it is inferred that 35%, companies employed less than 100 workers, 41% companies between 100-200 workers, 21% between 201-400 workers and only 3% of the companies employed more than 400 workers.

Table 6.2 Percentage for no of employees

No. of employees		Frequency	Percent
Valid	Less than 100	35	35.0
	101-200	41	41.0
	201-400	21	21.0
	401 and above	3	3.0
	Total	100	100.0

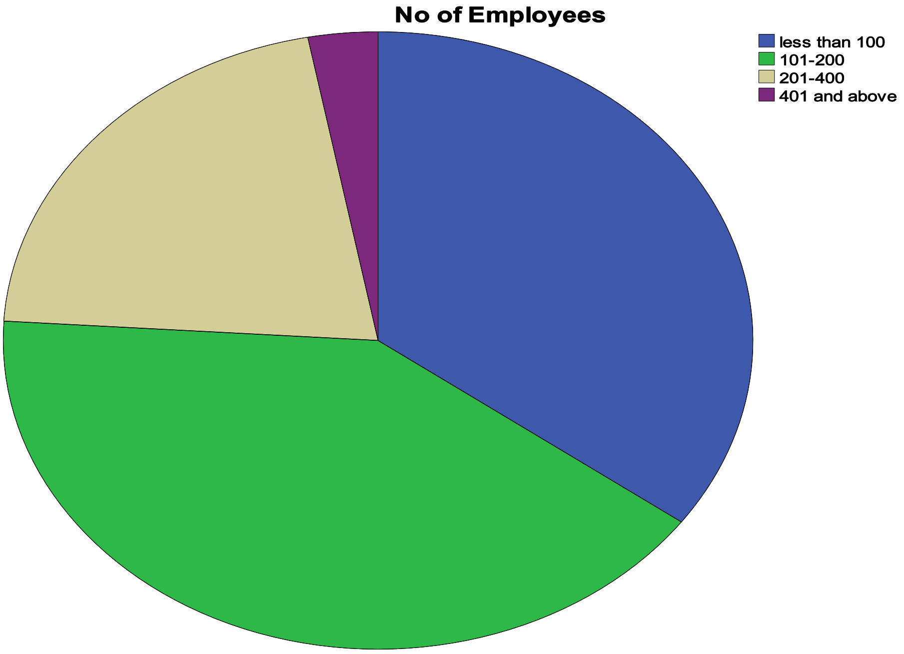


Figure 6.2 Pie chart for no of employees

6.13.3 IT budget wise respondents

Survey analysis shows that 31% of companies spent less than £0.1 million for IT facilities, 47%, allocated £0.11-0.3 million, 17%, between £0.31 -0.40 million, and only 5% of the companies spent £0.41-0.50 million on establishing IT infrastructure.

Table 6.3 Percentage for IT budget

IT Budget		Frequency	Percent
Valid	less than 0.1 m	31.0	31.0
	0.11m-0.30m	47.0	47.0
	0.31m-0.40m	17.0	17.0
	0.41m-0.50m	5.0	5.0
	Total	100	100.0

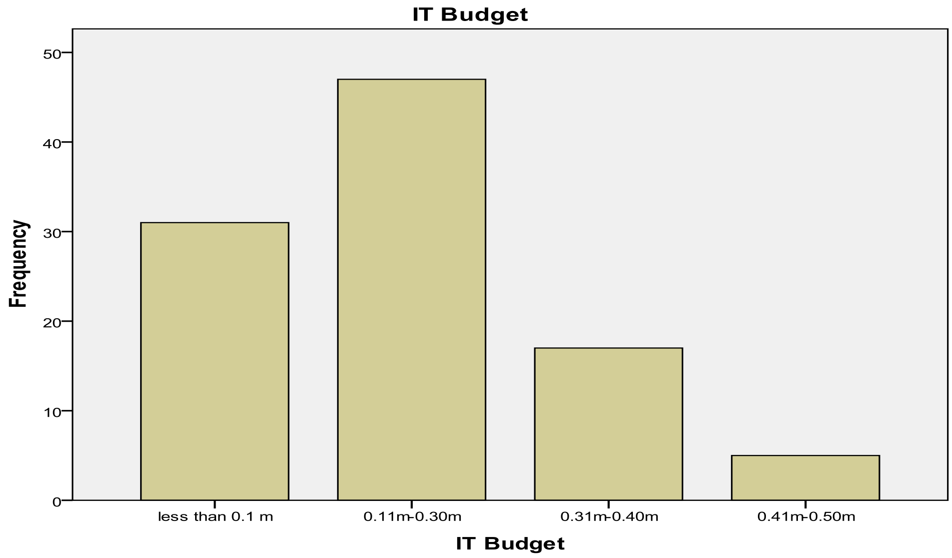


Figure 6.3 Bar chart for IT budget

6.13.4 Manufacturing module with cloud based ERP wise respondents

From Table 6.4, it is inferred that 96% of companies surveyed did have ERP system but no manufacturing modules or cloud application in their ERP software. Only 4% of the SMEs had cloud ERP system but the manufacturing features integrated in the system were very basic and limited.

Table 6.4 Percentage for respondents from manufacturing module cloud ERP implementation unit

Manufacturing module with cloud ERP		Frequency	Percent	Valid percent	Cumulative percent
Valid	Yes	4	4.0	4.0	4.0
	No	96	96.0	96.0	100.0
	Total	100	100.0	100.0	

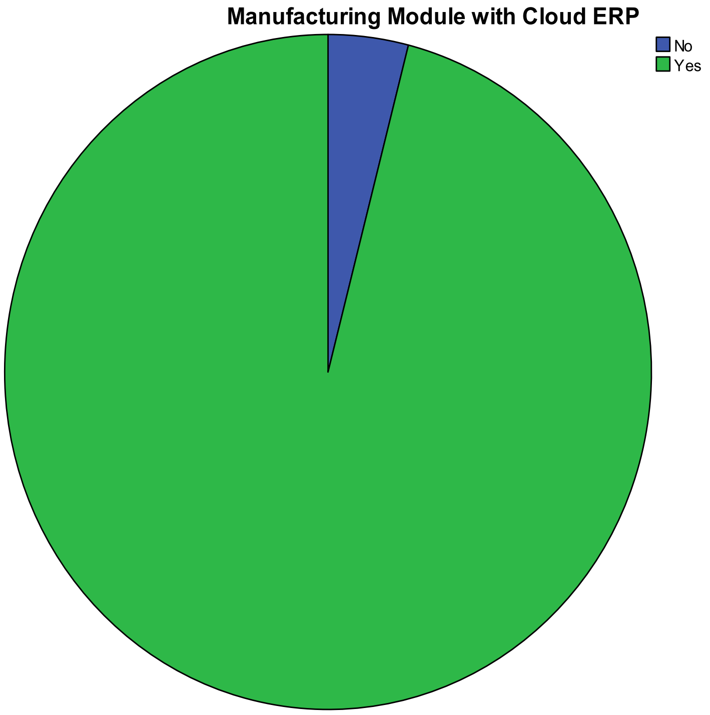


Figure 6.4 Pie chart for respondents from manufacturing module cloud ERP implementation unit

6.13 Descriptive statistics

6.14 Mean, standard deviation, Skewness and Kurtosis for CBMERP benefits parameters

Table 6.5a Mean, standard deviation, Skewness and Kurtosis for company strategy

Company Strategy	Strategy 1- Company strategy led to CBMERP	Strategy 2- CBMERP led to Company strategy	Strategy 3- Top management innovation and new ideas
Mean	3.8000	3.7500	3.4200
Std. Error of Mean	.10150	.09987	.11475
Std. Deviation	1.01504	.99874	1.14750
Skewness	-.650	-.469	-.516
Std. Error of Skewness	.241	.241	.241
Kurtosis	.107	-.265	-.407
Std. Error of Kurtosis	.478	.478	.478
Minimum	1.00	1.00	1.00
Maximum	5.00	5.00	5.00

Table 6.5b Mean, Standard Deviation, Skewness and Kurtosis for Top Management

Top Management	Top Management Support 1- Worth Investment	Top Management Support 2-Strong Top Management
Mean	4.5700	3.3600
Std. Error of Mean	.10469	.12187
Std. Deviation	1.04693	1.21871
Skewness	-2.399	-.350
Std. Error of Skewness	.241	.241
Kurtosis	4.624	-.755
Std. Error of Kurtosis	.478	.478
Minimum	1.00	1.00
Maximum	5.00	5.00

Table 6.5c Mean, standard deviation, Skewness and Kurtosis for motivation

Motivation	Motivation 1- financial motivation	Motivation 2- Operational Motivation	Motivation 3- technological motivation	Motivation 4- strategic motivation
Mean	3.4400	3.6300	3.6500	3.5300
Std. Deviation	1.22532	1.15168	1.10440	1.17598
Skewness	-.396	-.487	-.413	-.454
Std. Error of Skewness	.241	.241	.241	.241
Kurtosis	-.769	-.528	-.646	-.500
Std. Error of Kurtosis	.478	.478	.478	.478
Minimum	1.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00

Table 6.5d Mean, Standard Deviation, Skewness and Kurtosis for Challenges

Challenges	Challenge 1- Lack of idea, Information and Experience	Challenge 2- Limited Skill and Lack of time	Challenge 3- Employee Attitude	Challenge 4-Lack of Support Structure	Challenge 5-Not Recognize benefits	Challenge 6- System too Complex	Challenge 7- Integration of Big Data
Mean	3.7600	3.6600	3.6500	3.8000	3.8400	3.9200	3.7900
Std. Error of Mean	.10552	.10466	.11492	.10050	.11166	.10018	.10852
Std. Deviation	1.05524	1.04659	1.14922	1.00504	1.11663	1.00182	1.08521
Skewness	-.660	-.355	-.499	-.256	-.698	-.514	-.586
Std. Error of Skewness	.241	.241	.241	.241	.241	.241	.241
Kurtosis	.069	-.608	-.493	-1.077	-.203	-.577	-.362
Std. Error of Kurtosis	.478	.478	.478	.478	.478	.478	.478
Minimum	1.00	1.00	1.00	2.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Table 6.5e Mean, standard deviation, Skewness and Kurtosis for business process re-engineering

Business Process Reengineering	Business Process Reengineering 1 - Updated IT Skill	Business Process Reengineering 2 - Revised Business Process
Mean	3.7600	3.7300
Median	4.0000	4.0000
Std. deviation	1.07422	1.16216
Skewness	-.452	-.556
Std. error of Skewness	.241	.241
Kurtosis	-.643	-.607
Std. error of Kurtosis	.478	.478
Minimum	1.00	1.00
Maximum	5.00	5.00

Table 6.5f Mean, standard deviation, Skewness and Kurtosis for project management

Project Management	Project Management 1 - Qualified Staff and Experience	Project Management 2 - Sufficient Project Monitoring and Control	Project Management 3 - User Participation and Commitment	Project Management 4 - On time Project completed
Mean	3.7700	3.7400	3.8200	3.7600
Std. error of mean	.10996	.10975	.10577	.11021
Median	4.0000	4.0000	4.0000	4.0000
Std. deviation	1.09963	1.09747	1.05773	1.10206
Skewness	-.645	-.633	-.624	-.524
Std. error of Skewness	.241	.241	.241	.241
Kurtosis	-.200	-.218	-.171	-.512
Std. error of Kurtosis	.478	.478	.478	.478
Minimum	1.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00

Table 4.5 g. Mean, standard deviation, Skewness and Kurtosis for employee participation

Employee Participation	Employee Participation 1 - Consultation of CBMERP implementation	Employee Participation 2 - Integrated CBMERP implementation Team
Mean	3.6900	3.8000
Std. Error of Mean	.11432	.10636
Median	4.0000	4.0000
Std. Deviation	1.14323	1.06363
Skewness	-.646	-.463
Std. Error of Skewness	.241	.241
Kurtosis	-.182	-.596
Std. Error of Kurtosis	.478	.478
Minimum	1.00	1.00
Maximum	5.00	5.00

Table 6.5h Mean, standard deviation, Skewness and Kurtosis for reliability

Reliability	Reliability 1 - Traditional Computing Method	Reliability 2 - More Functionality/Features
Mean	3.8700	3.6000
Std. Error of Mean	.10314	.11721
Median	4.0000	4.0000
Std. Deviation	1.03138	1.17207
Skewness	-.636	-.592
Std. Error of Skewness	.241	.241
Kurtosis	-.010	-.346
Std. Error of Kurtosis	.478	.478
Minimum	1.00	1.00
Maximum	5.00	5.00

Table 6.5i Mean, standard deviation, Skewness and Kurtosis for training and education

Training of Education	Training of Education 1 - New Skill Set among the employees	Training of Education 2 - Fair Amount of Training Programme	Training of Education 3 - Training Programme Understandable
Mean	4.5700	3.4500	3.4700
Std. Error of Mean	.09239	.12583	.12984
Median	5.0000	4.0000	4.0000
Std. Deviation	.92392	1.25831	1.29845
Skewness	-2.248	-.412	-.540
Std. Error of Skewness	.241	.241	.241
Kurtosis	4.476	-.807	-.697
Std. Error of Kurtosis	.478	.478	.478
Minimum	1.00	1.00	1.00
Maximum	5.00	5.00	5.00

Tables 6.5a to 6.5i represent the 9 parameters that are considered in the CBMERP framework. All the questions were responded by 100 participants. The scores range between 1.00 and 5.00 for all the parameters which indicate that the respondents are neutral, on an average but the scores range between 3.5 - 4.5 which implies that they mostly agreed with the parameters. Standard deviation calculates the amount of deviation from the mean value and reflects the degree to which the values in a distribution differ from the arithmetic means (Bryman and Cramer, 2005). Data analysis in Tables 6.5 to 6.5i, shows that the largest deviation is approximately 1.3 for training program, which is the largest dispersion. The standard error of the mean is directly proportional to the dispersion which clarifies that the standard error is very high. The Skewness and Kurtosis represents the indications of the symmetry and peakendness of the distribution. Positive and negative Skewness represent the values clustered to the left or right of the table respectively. Positive and negative Kurtosis represent

the distribution is relatively peaked or relatively flat. The Kurtosis for most of the parameters were negative, whereas for few parameters it was positive, which indicates that the responses were different from the others.

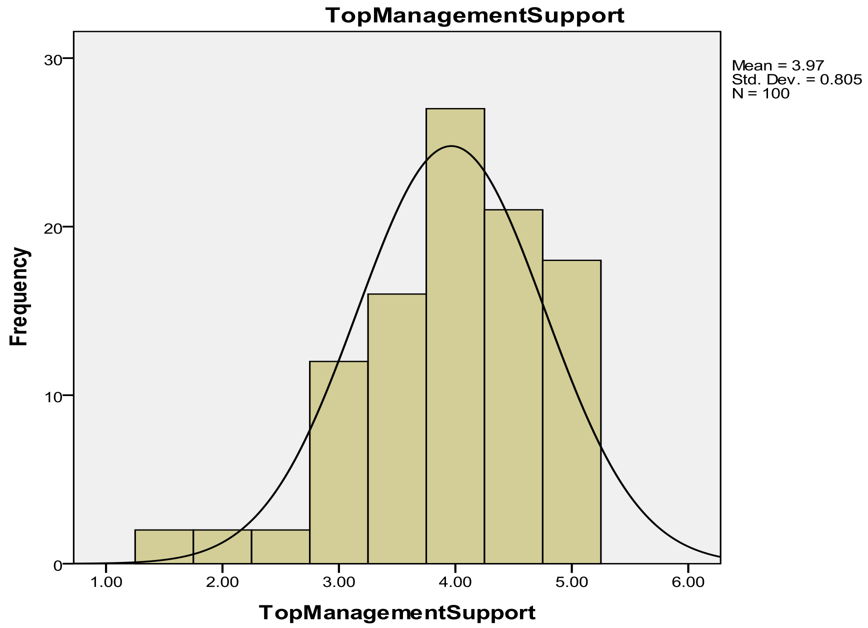
6.14.4 Skewness and Kurtosis Ratio for CBMERP benefits Parameters

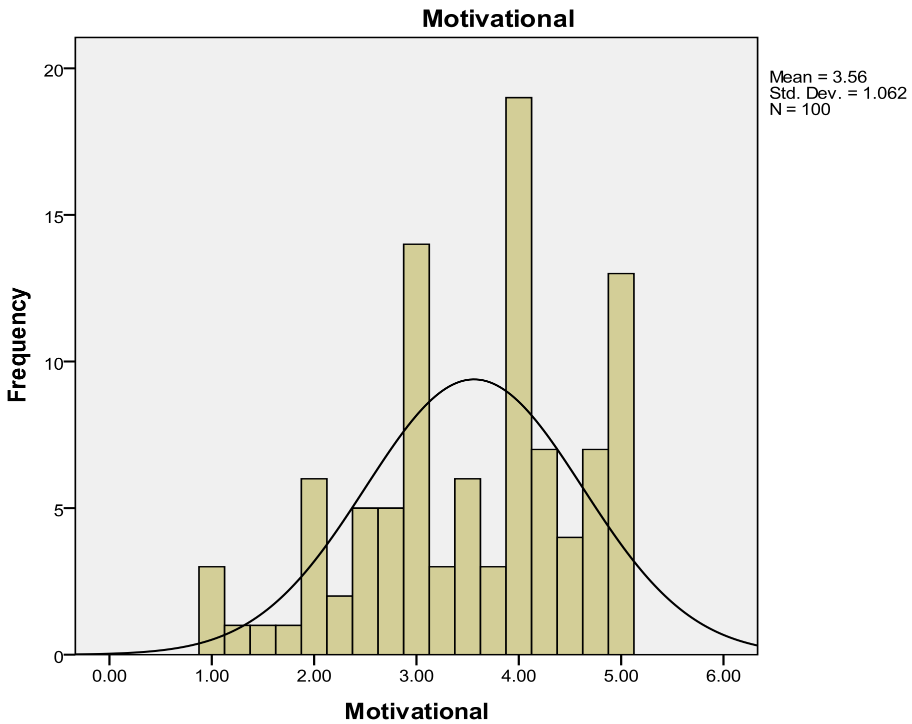
From Table 6.6, is very clear that, all the Skewness and Kurtosis ratio are less than 1.96 which indicates that the normal distribution graphs in Figure 6.6 supports these statements.

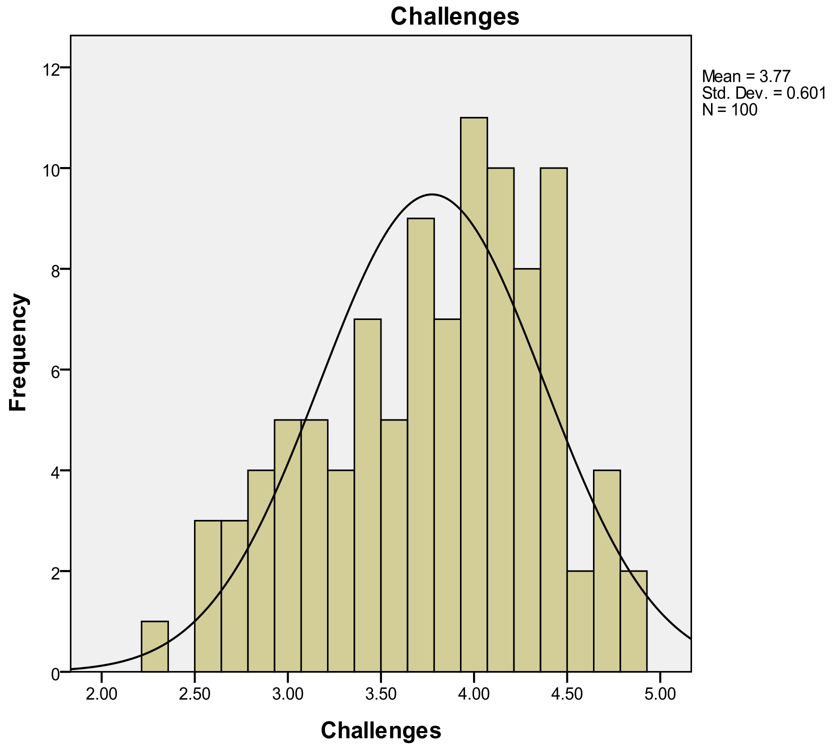
Table 6.6 Skewness and Kurtosis ratio for CBMERP benefits parameters

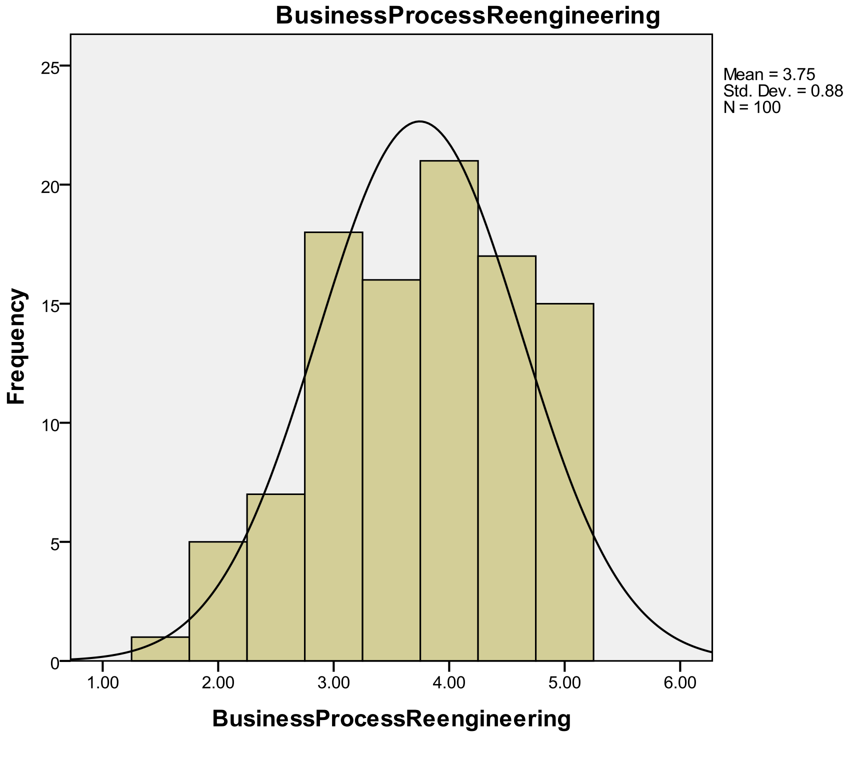
Parameter	M	CH	BPR	PM	EP	RE	TOE	CS	TMS
Skewness	-.505	-.388	-.329	-.533	-.399	-.271	-.405	-.178	-.803
Std. Error of Skewness	.241	.241	.241	.241	.241	.241	.241	.241	.241
Kurtosis	-.450	-.631	-.646	-.281	-.357	-.709	-.410	-.654	.652
Std. Error of Kurtosis	.478	.478	.478	.478	.478	.478	.478	.478	.478
Skewness / Kurtosis Ratio	1.122	0.615	0.508	1.899	1.117	0.383	0.990	0.273	-1.233

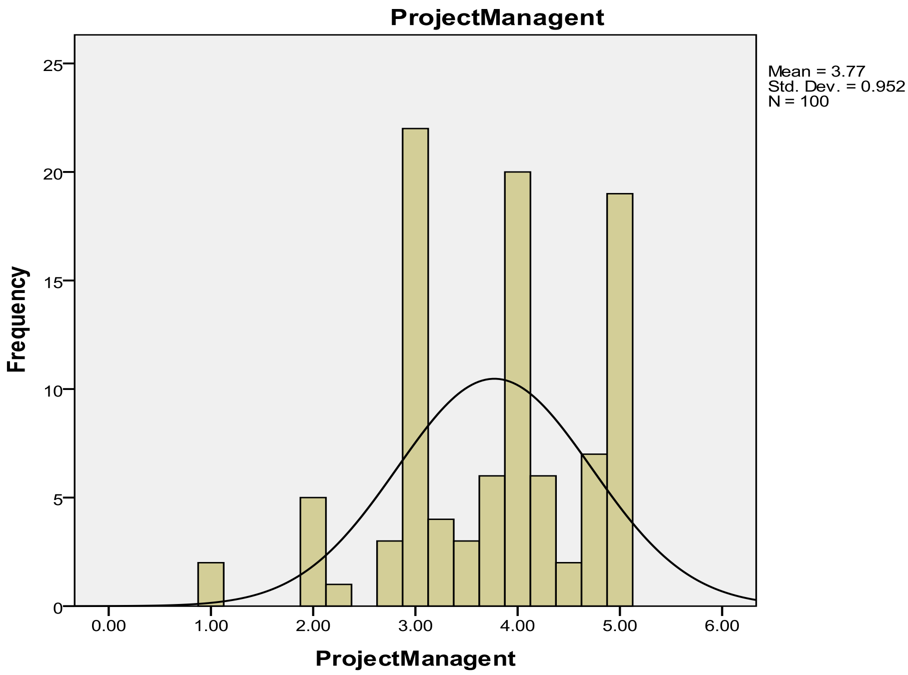
Note: M-Motivation, CH-Challenges, BPR-Business process reengineering, PM-Project Management, EP-Employee participation, RE-Reliability, TE-Training and education, CS-Company strategy, TMS-Top management support

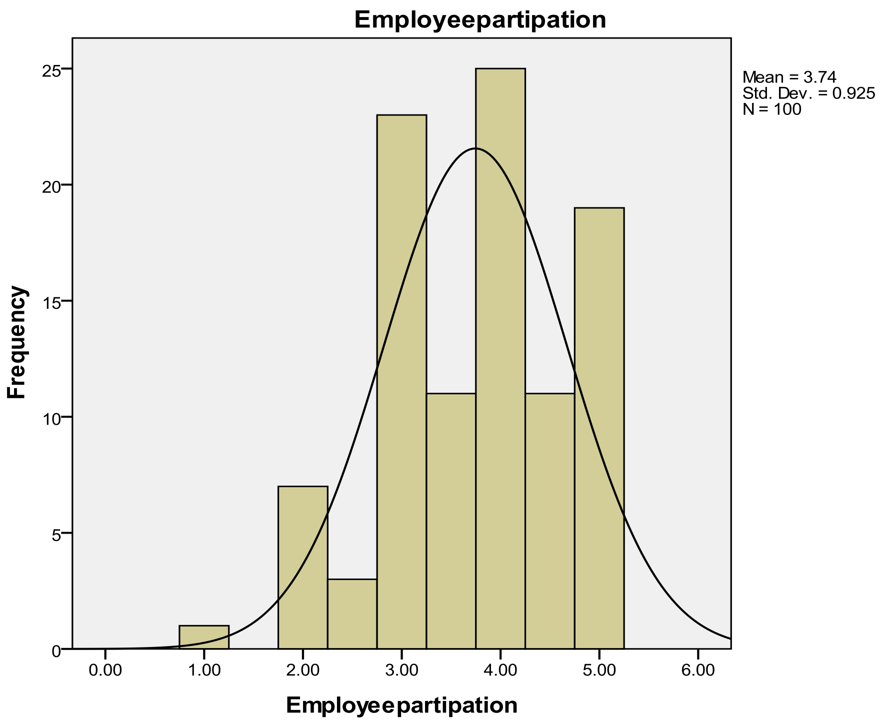

TopManagementSupport
Mean = 3.97
Std. Dev. = 0.805
N = 100
Frequency
30
20
10
0
1.00
2.00
3.00
4.00
5.00
6.00
TopManagementSupport

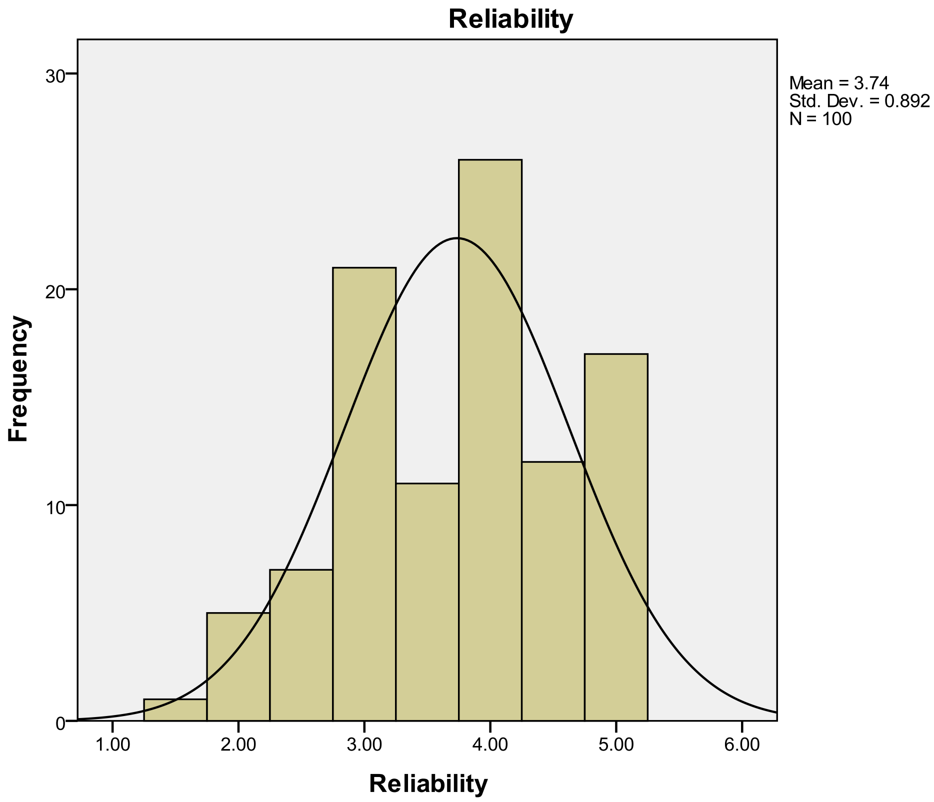

Motivational
Mean = 3.56
Std. Dev. = 1.062
N = 100
Frequency
20
15
10
5
0
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Motivational


Challenges
Mean = 3.77
Std. Dev. = 0.601
N = 100
Frequency
0
2
4
6
8
10
12
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Challenges


BusinessProcessReengineering
Mean = 3.75
Std. Dev. = 0.88
N = 100
Frequency
0
5
10
15
20
25
1.00
2.00
3.00
4.00
5.00
6.00
BusinessProcessReengineering


ProjectManagent
Mean = 3.77
Std. Dev. = 0.952
N = 100
Frequency
0
5
10
15
20
25
0.00
1.00
2.00
3.00
4.00
5.00
6.00
ProjectManagent


Employeepartipation
Mean = 3.74
Std. Dev. = 0.925
N = 100
Frequency
0
5
10
15
20
25
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Employeepartipation



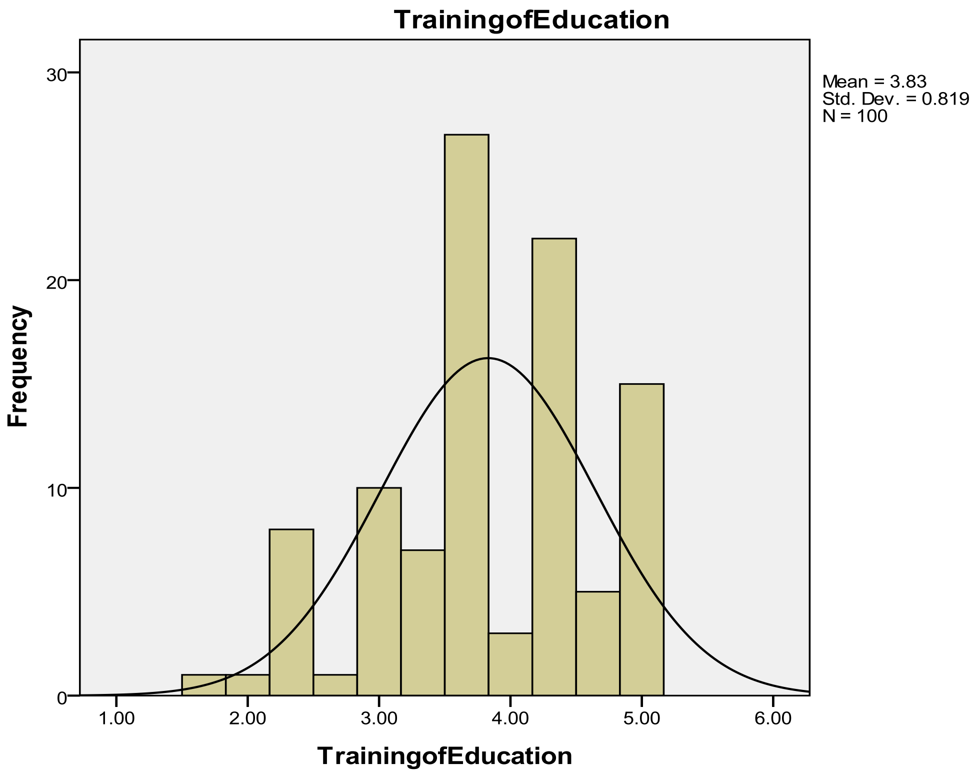


Figure 6.6. Normal distribution curve for different CBMERP benefits parameters

6.14.5 Box plot for CBMERP benefits parameters

Box plot is a graphical representation of data that shows a data set's lowest value, highest value, median value, and the size of the first and third quartile. Box plot is useful in analyzing small data sets that do not lend themselves easily to histograms. Because of the small size of a box plot, it is easy to display and compare several box plots in a small space. A box plot is a good alternative or complement to a histogram and is usually better for showing several simultaneous comparisons. Box plots display differences between populations without making any assumptions of the underlying statistical distribution: they are non-parametric. The spacing between the different parts of the box help indicate the degree of dispersion (spread) and skewness in the data, and identify outliers. In addition to the points themselves, they allow one to visually estimate various L-estimators, notably the inter quartile range, mid hinge, range, mid-range, and tri mean. Box plots can be drawn either horizontally or vertically. Box and whisker plots are uniform in their use of the box: the bottom and top of the box are always taken as the first and third quartiles and the band inside the box is always taken as the second quartile (the median). But the ends of the whiskers can represent several possible alternative values, among them: the minimum and maximum of all of the data as seen in Figure 6.7. One standard deviation is taken as above and below the mean of the data. The illustration shows a generic Figure 6.7 of a box plot with the maximum, third quartile, median, first quartile, and minimum values labeled. The relative vertical spacing between the labels reflects the values of the variable in proportion. Figure 6.7 shows the locations of the five marks on the box plot that are be equally spaced since the data is normally distributed.

1 - Minimum   3 - Median

2 – First Quartile 4 - third Quartile

5 - Maximum

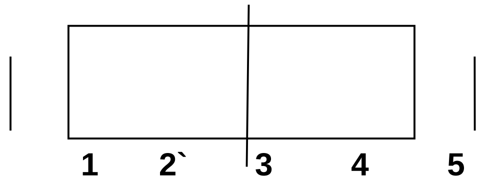
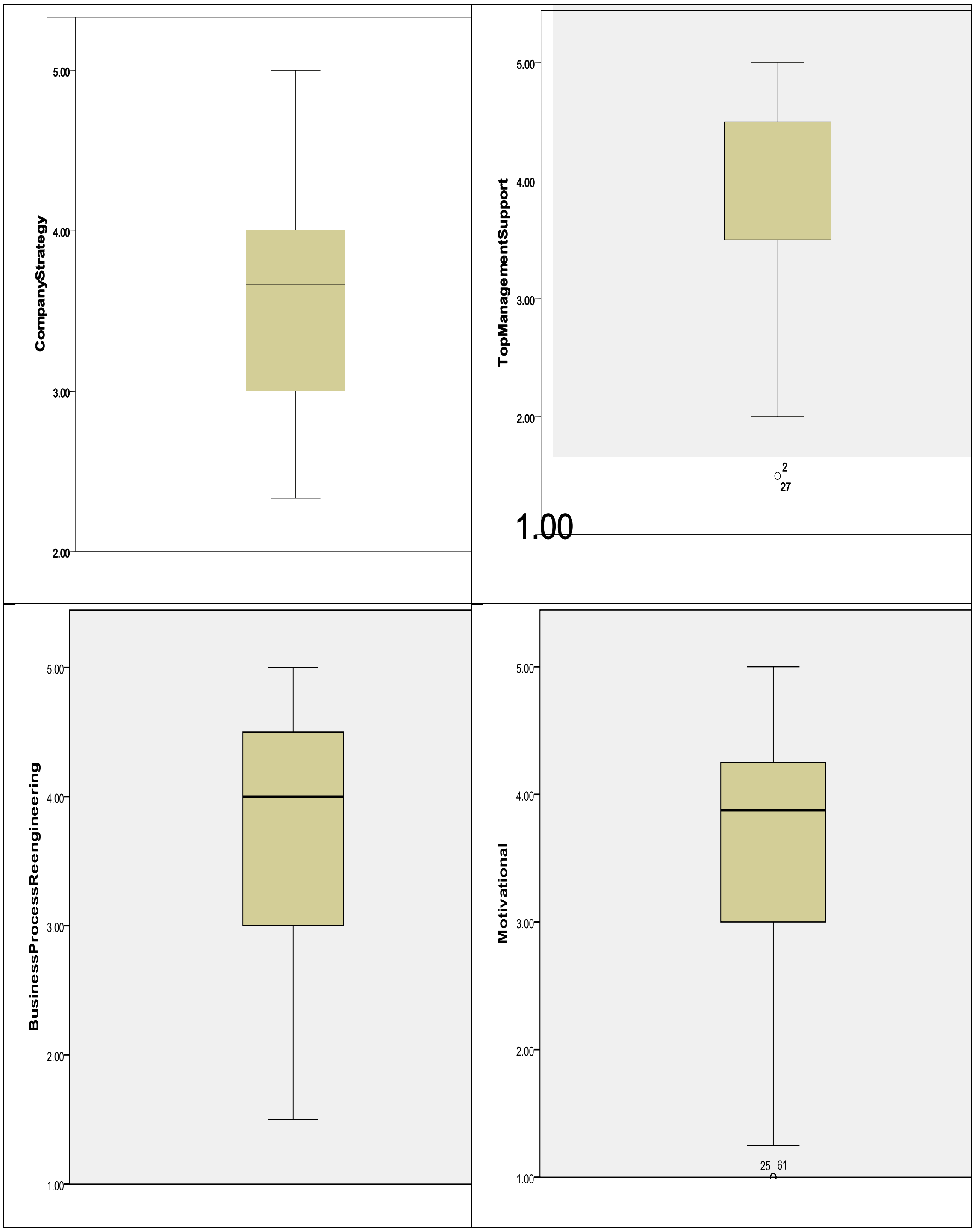
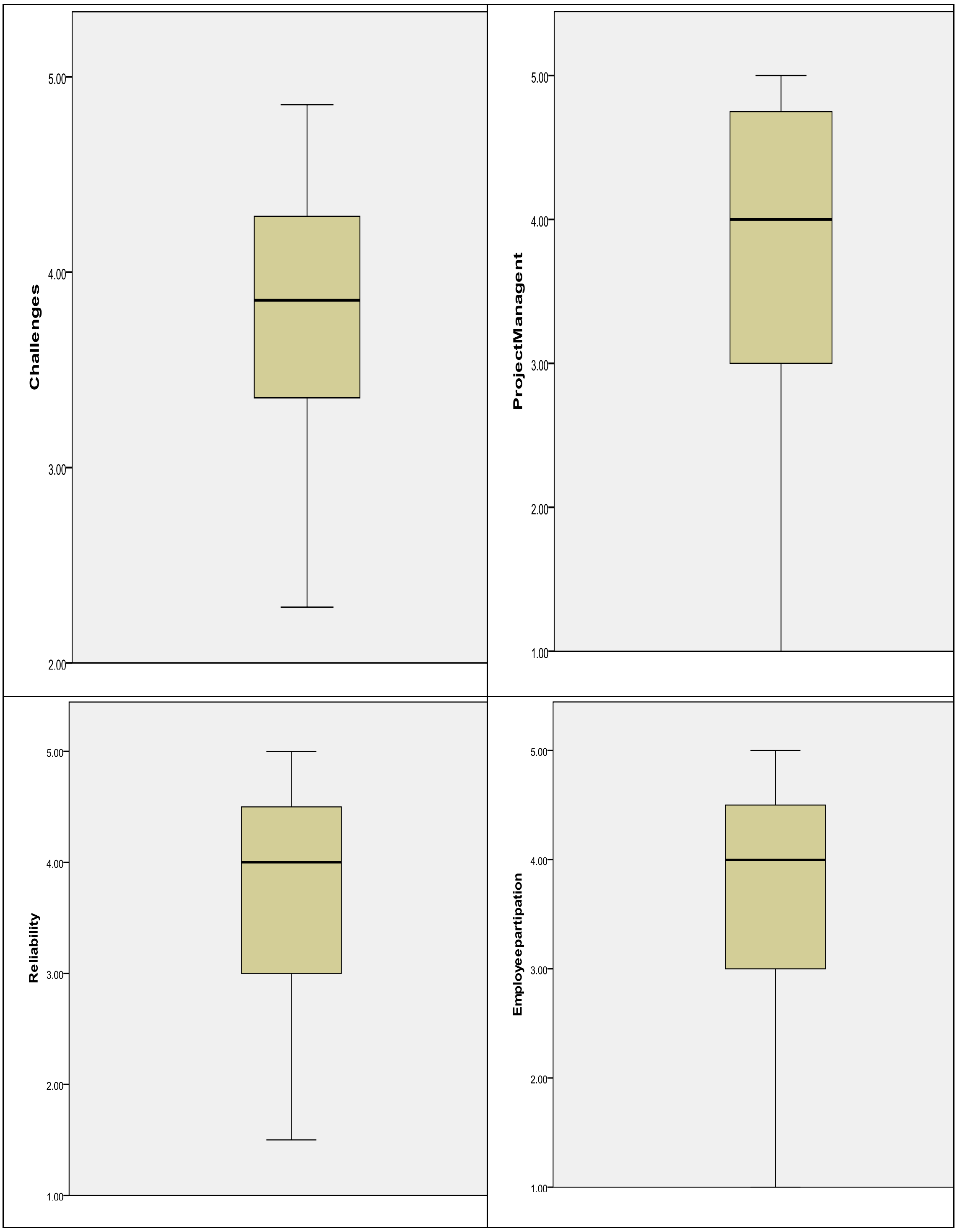


Figure 6.7 Model diagram for box plot





Challenges
5.00
4.00
3.00
2.00
ProjectManagent
5.00
4.00
3.00
2.00
1.00
Reliability
5.00
4.00
3.00
2.00
1.00
Employeepartipation
5.00
4.00
3.00
2.00
1.00

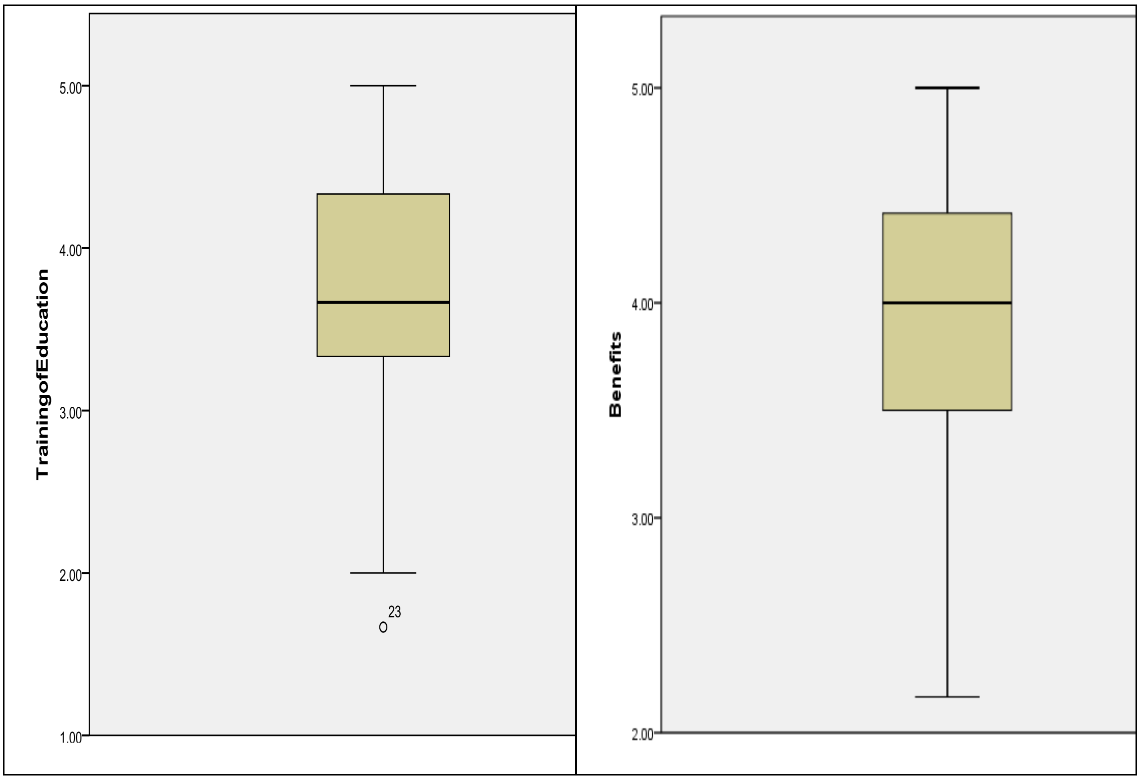


Figure 6.8 Box plot diagram for CBMERP benefits Factors

Figure 6.8 shows the illustration of a generic box plot with the maximum, third quartile, median, first quartile and minimum values labeled. The relative vertical spacing between the labels reflects the values of the variable in proportion. From the Figure 6.8, the locations of the five marks on the box plot will be equally spaced because of the data is normally distributed.

6.15 Inferential analysis

6.15.0 Paired sample test for CBMERP benefits and CBMERP parameters

Different parameters in the proposed model were analyzed through paired sample test to evaluate the CBMERP benefits and test results are shown in Table 6.7. A two-tailed test is a statistical test in which the critical area of a distribution is two-sided and tests whether a sample is greater than or less than a certain range of values.

If the sample being tested falls into either of the critical areas, the alternative hypothesis is accepted instead of the null hypothesis

Null hypothesis (H_O)

There is no relationship between the different parameters and CBMERP benefits.

Alternate hypothesis (H_1)

There is relationship between the different parameters and CBMERP benefits

Table 6.7 Paired sample test for different parameters and CBMERP benefits

Pairs		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Company Strategy - Benefits	-.28500	.85454	.08545	-.45456	-.11544	-3.335	99	.001
Pair 2	Top Management Support - Benefits	.02333	.83351	.08335	-.14205	.18872	.280	99	.780
Pair 3	Motivational - Benefits	-.37917	.97797	.09780	-.57322	-.18512	-3.877	99	.000
Pair 4	Challenges - Benefits	-.16738	.58347	.05835	-.28315	-.05161	-2.869	99	.005
Pair 5	Business Process Reengineering - Benefits	-.19667	.77285	.07728	-.35002	-.04332	-2.545	99	.012
Pair 6	Project Management - Benefits	-.16917	.63822	.06382	-.29580	-.04253	-2.651	99	.009
Pair 7	Employee participation - Benefits	-.19667	.74173	.07417	-.34384	-.04949	-2.651	99	.009
Pair 8	Reliability - Benefits	-.20667	.73440	.07344	-.35239	-.06095	-2.814	99	.006
Pair 9	Training of Education - Benefits	-.11167	.93596	.09360	-.29738	.07405	-1.193	99	.236

Analysis from Table 6.7, indicates that for the variables had a significance value less than 0.05 at 5% level of significance, thus the null hypothesis is rejected. Therefore, it can be interpreted that relationship between the CBMERP benefits parameters and CBMERP benefits other than the top management support–benefits and training of education-benefits.

6.15.1 Independent sample test CBMERP benefits parameters

Analysis in Table 6.8 shows that the independent sample test result for different parameters. Levene's test for equality of variances clarifies that the hypothesis for the two population variance is equal. For strategy 1- company strategy led to CBMERP, strategy 3-top management innovation and new ideas, top management support 1- worth investment, challenge 1-lack of idea, information and experience, business process reengineering 2 - revised business process, employee participation 2 - integrated CBMERP implementation team and training of education 1 - new skill set, the Levene's test the level of significance is $p < 0.01$. Assumption is made that the population variance is rejected. For other questions, the significance level, p is greater than 0.01, which indicates the equal variance must be assumed and t-test should be used.

Table 6.8 Independent sample T test for CBMERP benefits parameters

Parameters		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Strategy 1- Company strategy led to CBMERP	Equal variances assumed	7.190	.009	.859	98	.393	.19048	.22179	-.24967	.63062
	Equal variances not assumed			.980	75.747	.330	.19048	.19442	-.19676	.57771
Strategy 2- CBMERP led to Company strategy	Equal variances assumed	.010	.919	-.763	98	.447	-.16667	.21840	-.60008	.26675
	Equal variances not assumed			-.749	52.717	.457	-.16667	.22250	-.61300	.27967
Strategy 3- Top management innovation and new ideas	Equal variances assumed	6.208	.014	-.493	98	.623	-.12381	.25137	-.62264	.37503
	Equal variances not assumed			-.563	76.265	.575	-.12381	.21974	-.56143	.31381
Top Management Support 1- Worth Investment	Equal variances assumed	8.249	.005	-1.489	98	.140	-.33810	.22707	-.78870	.11251
	Equal variances not assumed			-1.298	41.847	.201	-.33810	.26045	-.86375	.18756
Top Management Support 2-Strong Top Management	Equal variances assumed	2.335	.130	-.321	98	.749	-.08571	.26716	-.61588	.44445

	Equal variances not assumed			-.342	64.023	.733	-.08571	.25047	-.58608	.41465
Motivation 1-Financial Motivation	Equal variances assumed	.194	.661	.142	98	.888	.03810	.26872	-.49517	.57136
	Equal variances not assumed			.144	57.079	.886	.03810	.26428	-.49111	.56730
Motivation 2-Operational Motivation	Equal variances assumed	.601	.440	.585	98	.560	.14762	.25216	-.35277	.64801
	Equal variances not assumed			.608	59.932	.546	.14762	.24291	-.33829	.63353
Motivation 3-Technological Motivation	Equal variances assumed	.101	.752	.098	98	.922	.02381	.24221	-.45686	.50448
	Equal variances not assumed			.099	56.029	.921	.02381	.24014	-.45724	.50486
Motivation 4-Strategic Motivation	Equal variances assumed	1.996	.161	.946	98	.347	.24286	.25676	-.26667	.75238
	Equal variances not assumed			1.020	65.851	.311	.24286	.23800	-.23234	.71806
Challenge 1-Lack of idea, Information and Experience	Equal variances assumed	10.204	.002	1.498	98	.137	.34286	.22884	-.11127	.79698
	Equal variances not assumed			1.730	78.038	.088	.34286	.19818	-.05169	.73740
Challenge 2-Limited Skill and Lack of time	Equal variances assumed	.002	.964	-.582	98	.562	-.13333	.22915	-.58808	.32141

	Equal variances not assumed			-.575	53.451	.568	-.13333	.23199	-.59855	.33188
Challenge 3-Employee Attitude	Equal variances assumed	.044	.834	-.094	98	.925	-.02381	.25205	-.52398	.47637
	Equal variances not assumed			-.094	54.687	.925	-.02381	.25257	-.53003	.48241
Challenge 4-Lack of Support structure	Equal variances assumed	.353	.554	.000	98	1.000	.00000	.22043	-.43744	.43744
	Equal variances not assumed			.000	51.411	1.000	.00000	.22719	-.45601	.45601
Challenge 5-Not Recognize benefits	Equal variances assumed	.098	.755	.545	98	.587	.13333	.24454	-.35195	.61861
	Equal variances not assumed			.539	53.571	.592	.13333	.24731	-.36259	.62926
Challenge 6-System too Complex	Equal variances assumed	.684	.410	-.347	98	.729	-.07619	.21959	-.51196	.35958
	Equal variance not assumed			-.340	52.542	.735	-.07619	.22405	-.52568	.37330
Challenge 7-Integration of Big Data	Equal variances assumed	1.913	.170	.060	98	.952	.01429	.23801	-.45804	.48661
	Equal variances not assumed			.057	49.331	.955	.01429	.25017	-.48837	.51694
Business Process Reengineering 1 - Updated IT Skill	Equal variances assumed	.020	.888	.445	98	.657	.10476	.23537	-.36232	.57184
	Equal variances not assumed			.451	56.670	.654	.10476	.23220	-.36027	.56980

Business Process Reengineering 2 - Revised Business Process	Equal variances assumed	5.102	.026	-.731	98	.467	-.18571	.25420	-.69017	.31874
	Equal variances not assumed			-.666	45.392	.509	-.18571	.27869	-.74689	.37546
Project Management 1 - Qualified Staff and Experience	Equal variances assumed	.474	.493	-.217	98	.828	-.05238	.24112	-.53088	.42612
	Equal variances not assumed			-.213	52.607	.832	-.05238	.24588	-.54564	.44088
Project Management 2 - Sufficient Project Monitoring and Control	Equal variances assumed	1.379	.243	.158	98	.875	.03810	.24068	-.43952	.51571
	Equal variances not assumed			.149	48.141	.882	.03810	.25603	-.47664	.55283
Project Management 3 - User Participation and Commitment	Equal variances assumed	.004	.952	1.115	98	.267	.25714	.23053	-.20034	.71462
	Equal variances not assumed			1.100	53.217	.276	.25714	.23385	-.21185	.72614
Project Management 4 - On time Project completed	Equal variances assumed	1.825	.180	.039	98	.969	.00952	.24171	-.47015	.48919
	Equal variances not assumed			.038	49.868	.970	.00952	.25274	-.49815	.51720
Employee Participation 1 - Consultation of CBMERP implementation	Equal variances assumed	.155	.695	.628	98	.531	.15714	.25024	-.33945	.65373
	Equal variances not assumed			.644	58.306	.522	.15714	.24388	-.33098	.64526

Employee Participation 2 - Integrated CBMERP implementation Team	Equal variances assumed	7.169	.009	.204	98	.839	.04762	.23324	-.41523	.51047
	Equal variances not assumed			.182	43.446	.857	.04762	.26186	-.48031	.57555
Reliability 1 - Traditional Computing Method	Equal variances assumed	1.293	.258	.824	98	.412	.18571	.22543	-.26165	.63307
	Equal variances not assumed			.847	58.633	.400	.18571	.21918	-.25292	.62435
Reliability 2 - More Functionality/Features	Equal variances assumed	.993	.322	.557	98	.579	.14286	.25666	-.36648	.65219
	Equal variances not assumed			.534	50.101	.596	.14286	.26777	-.39495	.68066
Training of Education 1 - New Skill Set among the employees	Equal variances assumed	5.393	.022	1.159	98	.249	.23333	.20127	-.16608	.63274
	Equal variances not assumed			1.384	84.349	.170	.23333	.16865	-.10203	.56869
Training of Education 2 - Fair Amount of Training Programme	Equal variances assumed	.571	.452	1.129	98	.262	.30952	.27421	-.23463	.85368
	Equal variances not assumed			1.096	51.468	.278	.3952	.28246	-.25742	.87646
Training of Education 3 - Training	Equal variances assumed	.229	.633	.822	98	.413	.23333	.28381	-.32988	.79654

Programme Understandable	Equal variances not assumed			.795	51.054	.430	.23333	.29346	-.35580	.82247

6.5.2 Measurement of CBMERP benefits parameters based on chi-square test statistics

Chi square test is an important test amongst many tests for significance. It is a statistical measure used in the context of sampling analysis for comparing a variance to a theoretical variance. As a non-parametric test, it can be used to determine if categorical data shows dependence or the two classifications and the actual data when categories are used (Kothari, 1998). This test is applied to test the hypothesis. Results of chi square test for CBMERP parameters are presented in Table 6.9.

Null Hypothesis (H_0)

CBMERP Variables are not interrelated within the factors.

Alternative Hypothesis (H_1)

CBMERP Variables are interrelated within the factors.

Table 6.9 Chi square test for CBMERP parameters

Strategy	Strategy 1- Company strategy led to CBMERP	Strategy 2- CBMERP led to Company strategy	Strategy 3- Top management innovation and new ideas	
Chi-square	42.700^{a}	40.500^{a}	26.100^{a}	
df	4	4	4	
Asymp. Sig.	0.0000	0.0000	0.0000	
Top Management Support	Top Management Support 1- Worth Investment	Top Management Support 2-Strong Top Management		
Chi-square	248.300^{a}	13.800^{a}		
df	4	4		
Asymp. Sig.	0.0000	0.0080		
Motivation	Motivation 1- Financial Motivation	Motivation 2- Operational Motivation	Motivation 3- Technological Motivation	Motivation 4- Strategic Motivation
Chi-square	14.200^{a}	24.900^{a}	26.800^{a}	23.200^{a}
df	4	4	4	4
Asymp. Sig.	0.007	0.0000	0.0000	0.0000
Challenge	Challenge 1- Lack of idea, Information and Experience	Challenge 2-Limited Skill and Lack of time	Challenge 3- Employee Attitude	Challenge 4- Lack of Support Structure
Chi-square	38.800^{a}	31.900^{a}	26.800^{a}	10.560^{b}
df	4	4	4	3
Asymp. Sig.	0.0000	0.0000	0.0000	0.014
Challenge	Challenge 5- Not Recognize benefits	Challenge 6-System too Complex	Challenge 7- Integration of Big Data	
Chi-square	38.300^{a}	45.800^{a}	34.500^{a}	
df	4	4	4	
Asymp. Sig.	0.0000	0.0000	0.0000	
Project Management	Project Management 1 - Qualified Staff and Experience	Project Management 2 - Sufficient Project Monitoring and Control	Project Management 3 - User Participation and Commitment	Project Management 4 - On time Project completed
Chi-square	33.900^{a}	32.600^{a}	38.600^{a}	32.300^{a}
df	4	4	4	4
Asymp. Sig.	0.0000	0.0000	0.0000	0.0000

Employee Participation	Employee Participation 1 - Consultation of CBMERP implementation	Employee Participation 2 - Integrated CBMERP implementation Team		
Chi-square	30.500[a]	37.200[a]		
df	4	4		
Asymp. Sig.	0.0000	0.0000		
Reliability	Reliability 1 - Traditional Computing Method	Reliability 2 - More Functionality/Features		
Chi-square	46.100[a]	24.800[a]		
df	4	4		
Asymp. Sig.	0.0000	0.0000		
Training of Education	Training of Education 1 - New Skill Set among the employees	Training of Education 2 - Fair Amount of Training Programme	Training of Education 3 - Training Programme Understandable	
Chi-square	212.100[a]	12.800[a]	15.500[a]	
df	4	4	4	
Asymp. Sig.	0.0000	0.0120	0.004	

Analysis from Table 6.9 show that all the variables under statutory welfare measures have significance value less than 0.05 at 5% level of significance; therefore, the null hypothesis was rejected. Hence it can be concluded that parameters are satisfied with CBMERP measures in the organization.

6.15.3 Conceptual model of attrition (P) and hypothesis (H)

Karl Person's correlation coefficient is used to identify and measure the relationship between two variables. The validation methodology for CBMERP examines the relationships between employee satisfaction (the dependent variable) and the nine factors of interest: (1) company strategy (2) top management support (3) motivational (4) challenges (5) business process re-engineering (6) project management (7) employee participation (8) reliability (9) training and education. Pearson correlation was used to analyses correlation among the nine factors. Results of correlation analysis provides information the variation between the variables is linear or not. The results of the correlation analysis of various CBMERP parameters is summarized in table 6.10

.

Table 6.10 Correlation analysis for different CBMERP parameters

Parameters		Company Strategy	Top Management Support	Motivational	Challenges	Business Process Reengineering	Project Management	Employee participation	Reliability	Training of Education	Benefits
Company Strategy	Pearson Correlation	1	.343**	.366**	.473**	.151	.174	.190	.158	.012	.151
	Sig. (2-tailed)		.000	.000	.000	.134	.084	.059	.117	.906	.135
	N	100	100	100	100	100	100	100	100	100	100
Top Management Support	Pearson Correlation	.343**	1	.586**	.392**	.237*	.357**	.263**	.254*	.162	.381**
	Sig. (2-tailed)	.000		.000	.000	.018	.000	.008	.011	.107	.000
	N	100	100	100	100	100	100	100	100	100	100
Motivational	Pearson Correlation	.366**	.586**	1	.572**	.405**	.459**	.446**	.235*	.100	.440**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.019	.320	.000
	N	100	100	100	100	100	100	100	100	100	100
Challenges	Pearson Correlation	.473**	.392**	.572**	1	.608**	.755**	.670**	.573**	.337**	.593**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.001	.000
	N	100	100	100	100	100	100	100	100	100	100
Business Process Reengineering	Pearson Correlation	.151	.237*	.405**	.608**	1	.758**	.598**	.556**	.206*	.536**
	Sig. (2-tailed)	.134	.018	.000	.000		.000	.000	.000	.040	.000
	N	100	100	100	100	100	100	100	100	100	100
Project Management	Pearson Correlation	.174	.357**	.459**	.755**	.758**	1	.736**	.721**	.272**	.743**
	Sig. (2-tailed)	.084	.000	.000	.000	.000		.000	.000	.006	.000
	N	100	100	100	100	100	100	100	100	100	100
Employee participation	Pearson Correlation	.190	.263**	.446**	.670**	.598**	.736**	1	.566**	.285**	.611**
	Sig. (2-tailed)	.059	.008	.000	.000	.000	.000		.000	.004	.000
	N	100	100	100	100	100	100	100	100	100	100
Reliability	Pearson Correlation	.158	.254*	.235*	.573**	.556**	.721**	.566**	1	.452**	.593**

	Sig. (2-tailed)	.117	.011	.019	.000	.000	.000	.000		.000	.000
	N	100	100	100	100	100	100	100	100	100	100
Training of Education	Pearson Correlation	.012	.162	.100	.337**	.206*	.272**	.285**	.452**	1	.232*
	Sig. (2-tailed)	.906	.107	.320	.001	.040	.006	.004	.000		.020
	N	100	100	100	100	100	100	100	100	100	100
Benefits	Pearson Correlation	.151	.381**	.440**	.593**	.536**	.743**	.611**	.593**	.232*	1
	Sig. (2-tailed)	.135	.000	.000	.000	.000	.000	.000	.000	.020	
	N	100	100	100	100	100	100	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed)											
*. Correlation is significant at the 0.05 level (2-tailed)											

Company Strategy Measures: positive and no significant correlation with CBMERP implementation benefits.

As seen from Table 6.10, there is no significant correlation (at the $p > 0.001$ level) between company strategy and CBMERP implementation benefits. This means the hypothesis is not supported.

***Top Management Support Measures: positive and significant correlation with CBMERP implementation benefits*.**

There is a significant correlation (at the $p < 0.001$ level) between top management support and CBMERP implementation benefits. This means that hypothesis is supported.

Motivational Measures: positive and significant correlation with CBMERP implementation benefits.

There is significant correlation (at the $p < 0.001$ level) between motivational and CBMERP implementation benefits. This means that hypothesis is supported.

Challenges Measures: positive and significant correlation with CBMERP implementation benefits.

There is significant correlation (at the p <0.001 level) between challenges and CBMERP implementation benefits. This means that hypothesis is supported.

Business Process Reengineering: positive and significant correlation with CBMERP implementation benefits.

There is significant correlation (at the p <0.001 level) between business process reengineering and CBMERP implementation benefits. This means that hypothesis is supported.

Project Management: positive and significant correlation with CBMERP implementation benefits.

There is significant correlation (at the p <0.001 level) between project management and CBMERP implementation benefits. This means that hypothesis is supported.

Employee Participation: positive and significant correlation with CBMERP implementation benefits.

There is significant correlation (at the p <0.001 level) between employee participation and CBMERP implementation benefits. This means that hypothesis is supported.

Reliability: positive and significant correlation with CBMERP implementation benefits.

There is significant correlation (at the p <0.001 level) between reliability and CBMERP implementation benefits. This means that hypothesis is supported.

Training and Education: positive and significant correlation with CBMERP

There is significant correlation (at the p <0.001 level) between training of education and CBMERP implementation benefits. This means the hypothesis is supported. Table 6.11 shows the summary for the 9 hypotheses in the model.

Table 6.11 Result summary for the nine hypotheses in the model

Hypothesis	Accept
Company strategy measures: no positive or significant correlation with CBMERP implementation benefits.	No
Top management support measures: positive and significant correlation with CBMERP implementation benefits.	Yes
Motivational measures: positive and significant correlation with CBMERP implementation benefits	Yes
Challenges measures: positive and significant correlation with CBMERP implementation benefits	Yes
Business process reengineering: positive and significant correlation with CBMERP implementation benefits.	Yes
Project management: positive and significant correlation with CBMERP implementation benefits	Yes
Employee participation: positive and significant correlation with CBMERP implementation benefits	Yes
Reliability: positive and significant correlation with CBMERP implementation benefits	Yes
Training and education: positive and significant correlation with CBMERP implementation benefits	Yes

6.16 Data validation

6.16.1 Cronbach's Alpha test for CBMERP parameters

Cronbach's Alpha is the most common measure of internal consistency ("reliability"). It is generally used when you have multiple Likerts' questions in a survey/questionnaire that form a scale and you wish to determine if the scale is reliable. This technique helps to understand whether the questions in the questionnaire are a reliable measure of the same latent variable. The 65 questions have been labelled "Qu 1" through to "Qu 65" to perform Cronbach's Alpha test. Values of Cronbach's Alpha test are summarized in Table 6.12 and 6.13.

Table 6. 12 Cronbach's Alpha for total data

Case Processing Summary			
		N	%
Cases	Valid	100	100.0
	Excluded	0	.0
	Total	100	100.0

a. List wise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.877	65

From the Table 6.12, it is seen that the Cronbach's alpha is 0.877, which indicates a high level of internal consistency for the chosen scale and sample.

Table 6.13 Cronbach's Alpha for CBMERP Parameters

Reliability Statistics	
Cronbach's Alpha	No of Items
0.855	9

All the 9 factors chosen for the validation study produced a value of 0.855 in the Cronbach's Alpha test, which indicates a high level of internal consistency for the chosen scale and the sample.

6.16.2 Factor analysis

6.16.2 Factor analysis for the CBMERP benefits parameters

Factor analysis was used to identify major factors that contribute towards the CBMERP benefits and data reduction.

Statistics associated with the factor analysis

Bartlett's test of sphericity was used to test the null hypothesis and identify if the variables correlates with the population. The test of sphericity is based on the Chi-square transformation of the determinant of the correlation matrix.

Eigen-values and communalities

A factor's Eigen value or latent route is the sum of the squares of its factor loading. It helps to explain how well a given factor fits the data from all respondents on all the statements. Uniqueness of a variable: That is, uniqueness is the variability of a variable minus its communality. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. Communalities are the sum of squares of a statement's factor loading, i.e. it explains how much each variable is accounted for by the factors taken together. Bartlett's test of Sphericity and Kaiser Meyer Olkin measures of sample adequacy is used to test the appropriateness of the factor model.

6.16.2 Kolmogorov-Smirnov test/test for normality

In statistics, the Kolmogorov–Smirnov test (K–S test or KS test) is a nonparametric test of the equality of continuous, one-dimensional probability distributions that can be used to compare a sample with a reference probability distribution (one-sample K–S test), or to compare two samples (two-sample K–S test). KMO test is a measure of how suited your data is for Factor Analysis. The test measures sampling adequacy for each variable in the model and for the complete model. The statistic is a measure of the proportion of variance among variables that might be common variance'.

Null Hypothesis (H_0)

Distribution of sample data is normal

Alternative hypothesis (H_1)

Distribution of sample data is abnormal.

Table 6.14 KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy.		.820
Bartlett's test of sphericity	Approx. Chi-square	2309.075
	df	406
	Sig.	.000

High value of KMO (0.820 > .05) indicates that a factor analysis is useful for the present data. The significant value for Bartlett's test of Sphericity is 0.000 and less than 0.05 which indicates that there exists a significant relationship among the variables (Table 6.14). The resultant value of KMO test and Bartlett's test indicate that the present data is useful for factor analysis. The next step in the analysis is to decide the number of factors to be derived. This procedure is intended to reduce the complexity in a set of data. The rule of thumb is applied to choose the number of factors for which 'Eigen values' with greater than unity is taken by using Principal Component Analysis (PCA) method. The Component matrix so formed is further rotated orthogonally using Varimax Rotation Algorithm (VRA) which is the standard rotation method (Kaiser, 1958). All the statements were loaded on the se7 factors. Factor reduction data for CBMERP benefit parameters is presented in Table 6.15.

Table 6.15 Factor reduction table for CBMERP benefits parameters

	Component						
	1	2	3	4	5	6	7
Project Management 2 - Sufficient Project Monitoring and Control	.853						
Project Management 4 - On time Project completed	.842						
Project Management 3 - User Participation and Commitment	.814						
Challenge 7- Integration of Big Data	.806						
Project Management 1 - Qualified Staff and Experience	.753						
Challenge 3- Employee Attitude	.714	.453					
Business Process Reengineering 2 - Revised Business Process	.693						
Reliability 1 - Traditional Computing Method	.643						
Employee Participation 1 - Consultation of CBMERP implementation	.643						
Employee Participation 2 - Integrated CBMERP implementation Team	.573						

Business Process Reengineering 1 - Updated IT Skill	.572						
Challenge 4-Lack of Support Structure	.519	.428					
Challenge 5-Not Recognize benefits	.471						
Motivation 2- Operational Motivation		.898					
Top Management Support 2-Strong Top Management		.870					
Motivation 1- Financial Motivation		.863					
Motivation 3- Technological Motivation		.833					
Motivation 4- Strategic Motivation		.820					
Strategy 3- Top management innovation and new ideas		.696					
Training of Education 3 - Training Programme Understandable			.890				
Training of Education 2 - Fair Amount of Training Programme			.858				
Reliability 2 - More Functionality/Feature s	.546		.655				
Strategy 1- Company strategy led to CBMERP				.963			
Challenge 1-Lack of idea, Information and Experience				.955			
Challenge 2-Limited Skill and Lack of time					.958		

Strategy 2- CBMERP led to Company strategy					.956		
Training of Education 1 - New Skill Set among the employees						.673	
Challenge 6-System too Complex						-.480	.422
Top Management Support 1- Worth Investment							-.840

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 6 iterations.

Analysis in Table 6.16, shows 7 components for 29 variables. Based on the item loadings, these factors were respectively identified and explained in Table 6.17. Interpretation of factors is facilitated by identifying the statements that have large loadings in the same factor. The factors can be interpreted in terms of the statement that has high load.

Table 6. 17 Variable and factors for CBMERP benefits parameters

Factor	Variables
First	Project management 2 - sufficient project monitoring and control, project management 4 - on time project completed, project management 3 - user participation and commitment, challenge 7-integration of big data, project management 1 - qualified staff and experience, business process reengineering 2 - revised business process, reliability 1 - traditional computing method, employee participation 1 - consultation of CBMERP implementation, employee participation 2 - integrated CBMERP implementation team, business process reengineering 1 - updated IT skill, challenge 5-not recognize benefits.

Second	Challenge 3-employee attitude, challenge 4-lack of support structure, motivation 2-operational motivation, top management support 2-strong top management, motivation 1-financial motivation, motivation 3-technological motivation, motivation 4-strategic motivation, strategy 3- top management innovation and new ideas
Third	Training and education 3 - training programme understandable, training of education 2 - fair amount of training programme, reliability 2 - more functionality/features
Fourth	Strategy 1- company strategy led to CBMERP, challenge 1- lack of idea, information and experience
Five	Challenge 2-limited skill and lack of time, strategy 2- CBMERP led to company strategy
Six	Training and education 1 - new skill set among the employees
Seven	Challenge 6-system too complex, top management support 1- worth investment

6.16.3 Variance test for factor analysis result

Analysis in Table 6.18 indicates the all the factors taken in the validation study show 73.562%. Eigen Value represents the total variance explained by each factor and percentage of the total variance attributed to each factor. One of the popular methods used in Exploratory Factor Analysis (EFA) is Principal Component Analysis (PCA). In this method, the total variance in the data is considered to determine the minimum number of factors that will account for maximum variance of data.

Table 6.18 Variance table for CBMERP benefits parameters										
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension0	1	10.167	35.060	35.060	10.167	35.060	35.060	7.076	24.399	24.399
	2	2.994	10.322	45.383	2.994	10.322	45.383	5.146	17.745	42.144
	3	2.229	7.685	53.068	2.229	7.685	53.068	2.609	8.995	51.139
	4	1.979	6.823	59.891	1.979	6.823	59.891	2.014	6.945	58.084
	5	1.596	5.504	65.395	1.596	5.504	65.395	1.998	6.888	64.972
	6	1.257	4.336	69.731	1.257	4.336	69.731	1.263	4.357	69.329
	7	1.111	3.831	73.562	1.111	3.831	73.562	1.228	4.233	73.562
	8	.941	3.246	76.808						
	9	.829	2.859	79.667						
	10	.791	2.728	82.394						
	11	.744	2.566	84.961						
	12	.669	2.308	87.268						
	13	.547	1.885	89.153						
	14	.501	1.727	90.880						
	15	.393	1.357	92.237						
	16	.361	1.246	93.483						
	17	.289	.996	94.479						
	18	.273	.940	95.420						
	19	.224	.773	96.193						
	20	.205	.707	96.899						
	21	.161	.556	97.456						
	22	.159	.547	98.003						
	23	.133	.459	98.462						
	24	.119	.409	98.871						
	25	.093	.322	99.193						
	26	.081	.280	99.474						
	27	.063	.217	99.690						
	28	.057	.197	99.888						
	29	.033	.112	100.000						

Extraction Method: Principal Component Analysis.

6.16.4 Component score covariance matrix

Table 6.19 shows the Component Score Covariance Matrix after calculating the score using regression approach. The regression approach shows highest correlation between the factors and factor scores. The distribution of each factor score has a mean of zero and standard deviation of 1 in principle component analysis. The matrix illustrated in Table 6.19 is an identify matrix which means that the factors were not correlated with each other.

Table 6.19 Component score covariance matrix

Component		1	2	3	4	5	6	7
dimension	1	1.000	.000	.000	.000	.000	.000	.000
	2	.000	1.000	.000	.000	.000	.000	.000
	3	.000	.000	1.000	.000	.000	.000	.000
	4	.000	.000	.000	1.000	.000	.000	.000
	5	.000	.000	.000	.000	1.000	.000	.000
	6	.000	.000	.000	.000	.000	1.000	.000
	7	.000	.000	.000	.000	.000	.000	1.000

Figure 6.9 Screen plot for CBMERP benefits parameters

The screen plot in Figure 6.9 shows a steep slope between the large factors. The points at which the curve first begins to straighten out indicates the maximum number of factors to extract (HO, 2006). 7 factors were considered for screen plot analysis in the validation study.

6.17 Regression analysis for validation

Regression analysis is a mathematical measure of average relationship between two or more variables in terms of original units of data. Regression is used to create an equation or transfer function from the measurements of the system's inputs and output's acquired during a passive or active experiment (Kazmier, 2005). The transfer function is then used for sensitivity analysis, optimization of system performance and tolerance the system's components (Antis et al., 2006). A Path diagram *Figure 6.10) represents the response (CBMERB benefits) and the predictors i.e. (1) company strategy (2) top management support (3) motivational (4) challenges (5) business process re-engineering (6) project management (7) employee participation (8) reliability (9) training and education and its variables.

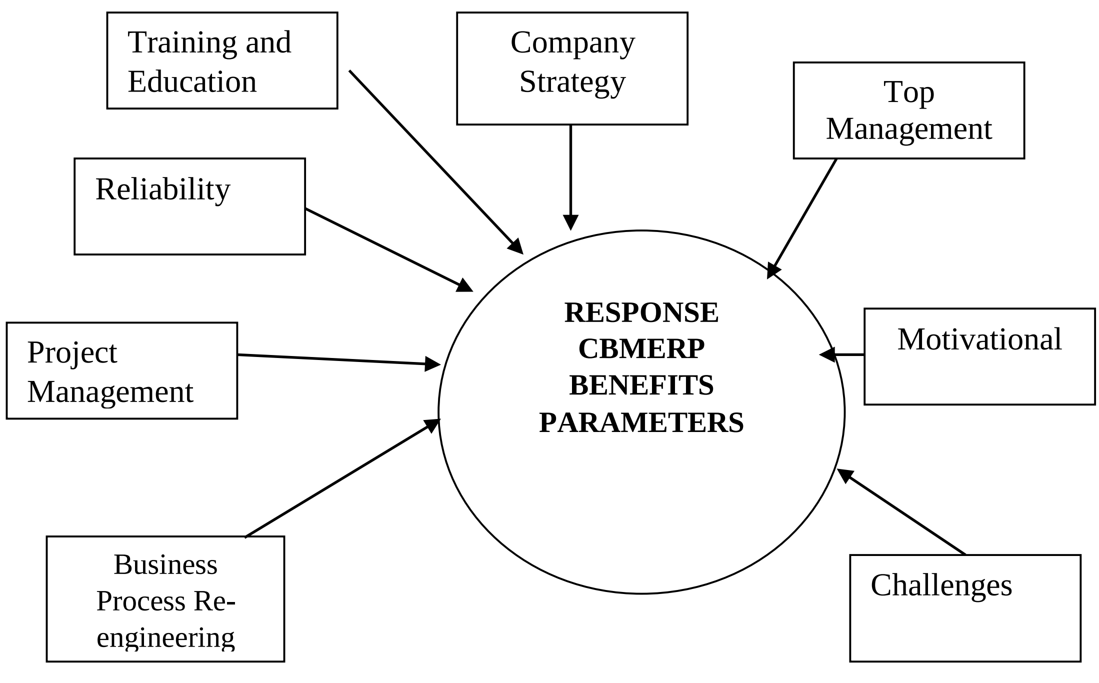


Figure 6.10 Path diagram for CBMERP benefits parameters

Multiple regression analysis was conducted in the validation using employee satisfaction (PAS) as a dependent variable and (1) company strategy (2) top management support (3) motivational (4) challenges (5) business process re-engineering (6) project management (7) employee participation (8) reliability (9) training and education and its variables as the independent variables. Out of 29 variables considered, only 8 variables were significant. Therefore, regression analysis was performed on these variables. Table 6.20, 6.21 and 6.22 show the summary of the regression results.

The regression model used for the analysis is shown below:

CBMERP benefits = f (Reliability 1 - traditional computing method, Strategy 2-CBMERP led to company strategy, Motivation 4-strategic motivation, Challenge 5-not recognize benefits, Project Management 3 - user participation and commitment, Motivation 1-financial motivation, Challenge 3-employee attitude, Challenge 2-limited skill and lack of time).

Table 6.20 Summary of the regression model

Model	R	R Square		Std. Error of the Estimate
1	.823[a]	.677	.648	.40469

a. Predictors: (Constant), Reliability 1 - traditional computing method, strategy 2- CBMERP led to company strategy, Motivation 4-strategic motivation, Challenge 5-not recognize benefits, Project Management 3 - user participation and commitment, Motivation 1-financial Motivation, Challenge 3-employee attitude, Challenge 2-limited Skill and lack of time

Table 6.21 ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31.173	8	3.897	23.793	.000[a]
	Residual	14.903	91	.164		
	Total	46.076	99			

a. Predictors: (Constant), Reliability 1 - traditional computing method, strategy 2- CBMERP led to company strategy, Motivation 4-strategic motivation, Challenge 5-not recognize benefits, Project Management 3 - user participation and commitment, Motivation 1-financial motivation, Challenge 3-employee attitude, Challenge 2-limited skill and lack of time

b. Dependent variable: Benefits

Transfer function for patient satisfaction was formulated in the analysis and is shown in the equation below:

CBMERP Benefits = 0.097 (Reliability 1 - traditional computing method) -0.286 (Strategy 2- CBMERP led to company strategy) + 0.216 (Motivation 4-strategic motivation) + 0.152 (Challenge 5-not recognize benefits) + 0.353 (Project Management 3 user participation and commitment) + 0.216 (Motivation 1-financial motivation) – 0.135 (Challenge 3-employee attitude) + 0.197 (Challenge 2-limited skill and lack of time) + 2.103…………..……………..(4. 1)

Table 6.22 Coefficients'

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.103	.246		8.559	.000
	Strategy 2- CBMERP led to Company strategy	-.286	.094	-.419	-3.058	.003
	Motivation 1-Financial Motivation	.216	.062	.387	3.469	.001
	Motivation 4-Strategic Motivation	-.104	.054	-.179	-1.923	.058
	Challenge 2-Limited Skill and Lack of time	.197	.088	.303	2.235	.028
	Challenge 3-Employee Attitude	-.135	.069	-.227	-1.959	.053
	Challenge 5-Not Recognize benefits	.152	.054	.248	2.802	.006
	Project Management 3 - User Participation and Commitment	.353	.062	.547	5.656	.000
	Reliability 1 - Traditional Computing Method	.097	.047	.147	2.087	.040

a. Dependent Variable:
Benefits

6.17.1 Regression model validation

F- test (ANOVA) is used when multiple sample case is involved. As the significance of the difference between the means of two samples can be judged through any test, the difficulty arises when one has to examine the significance of the difference amongst more than two sample means at the same time. Therefore, the F test has been selected as the appropriate tool for analysis. The F-ratio is significant at the 0.000 level, which means that the results of the regression models could hardly have occurred by chance (Chacker and Jabnoun, 2003).

The quality of the regression can also be assessed from a plot of residuals versus the predicted values. The plot shows no observable structure as shown in Figure 6.11. The above three points indicate that the model is acceptable.

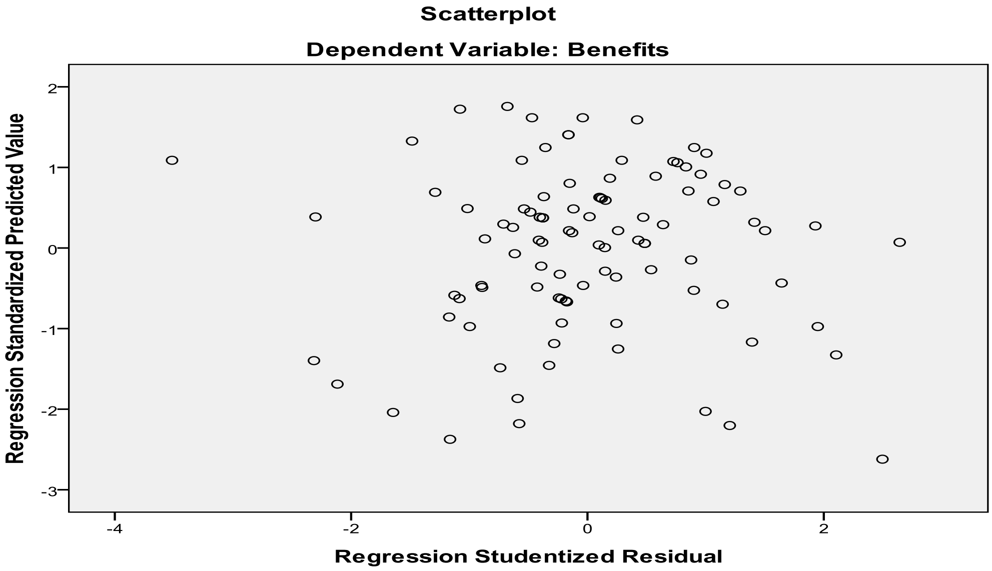


Figure 6.11 Residual versus predicted value for the regression model

The resulting multiple regression model is shown below:

CBMERP Benefits = 0.097 (Reliability 1 - traditional computing method) -0.286 (Strategy 2- CBMERP led to company strategy) + 0.216 (Motivation 4-strategic motivation) + 0.152 (Challenge 5-Not recognize benefits) + 0.353 (Project Management 3 user participation and commitment) + 0.216 (Motivation 1-financial motivation) – 0.135 (Challenge 3-employee attitude) + 0.197 (Challenge 2-limited skill and lack of time) + 2.103 ………………………………………. (4.1)

There was a positive relationship between the Reliability 1 - traditional computing method, Motivation 4-strategic motivation, Challenge 5-not recognize benefits, Project Management 3 -user participation and commitment, Motivation 1-financial motivation, Challenge 2-limited skill and lack of time.

CBMERP benefits were identified as the positive regression coefficient. The above predictors which strongly affect the response. Small variation in this input causes large variation in the response (CBMERP benefits).

6.18 Analysis for various manufacturing activities in CBMERP

All the manufacturing activities considered in CBMERP were analyzed statistically. Out of 100 professionals who responded to the survey 95 of the participants strongly agreed to the benefits of manufacturing activities integrated in CBMERP. This is clarified in Table 6.23 and Figure 6.12.

Table 6.23 Analysis manufacturing activities in CBMERP

Manufacturing Activities	No of Acceptance (Yes)	No of Rejection (No)
a) Improved production planning	86	14
b) Improved material management	82	18
c) Reduced work-in-progress	94	6
d) Increased productivity	85	15
e) Reduced bottleneck	92	8
f) Reduced downtime in manufacturing operations	95	5
g) Lead to achieve lean objectives	87	13
h) Improved quality management	89	11
i) Reduced inventory level	89	11
j) Streamlined manufacturing processes	87	13
k) Improved product management	91	9
l) Improved integration of various production processes	85	15
m) Improved maintenance activities	90	10
n) Improved delivery time	81	19

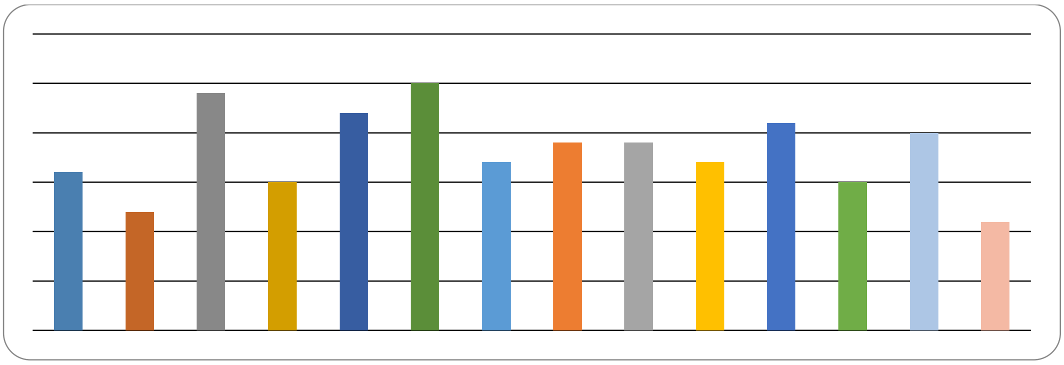


Figure 6.12 Analysis of manufacturing activities in CBMERP

6.19 GAP analysis for CBMREP manufacturing modules function

GAP analysis involved the comparison of actual performance with potential or desired performance. Analysis of categories, strongly agree and strongly disagree for manufacturing modules function included in CBMERP are summarized in Table 6.24. From the strongly agree and strongly disagree count, the gaps were calculated. Manufacturing processes, associated machinery and manpower factors were identified to have the largest gap. Hence, it can be considered to be a good response.

Table 6.24 Gap analysis for manufacturing modules function included in CBMERP

Manufacturing modules function included in CBMERP	Strongly Agree	Strongly disagree	Gap
Inventory	22	1	21
Work-in-progress tracking	25	3	22
Multi-level Bills of material	29	2	27
Supply chain manufacturing	21	1	20
Quality management	31	1	30
Warehouse management	26	3	23
Maintenance	26	1	25
Production feedback	21	6	15
Scheduling	32	6	26
Route tracking	32	2	30
Workstation management	28	3	25
Resource allocation	30	1	29
Manufacturing processes and associated machine and manpower	*42*	*2*	*40*

6.20 Summary of findings

The CBMERP conceptual framework was validated with the help of hypotheses and statistical tools through empirical study. The validation method proved to be an appropriate approach and accurate.

6.20.1 Findings from margin of error

- The margin of error is 2.94 %. It reflects that the estimate of the study does not match the statistics exactly but falls around 2.94 % of the statistics, because every sample is likely to differ from the population.

6.20.2 Findings from demographical analysis

- 25 % of technical support employees, 24 % manufacturing engineers and 21% of ERP analysts participated in the survey. The participants were aware of ERP application and knowledgeable about CBMERP. Hence, their views on survey questions can be assumed to be trustworthy and the results were reliable.
- The investment spent on IT facilities in 47% of the companies was only 0.1-0.3 million. These companies are willing to invest more on IT infrastructure to improve business performance and integrate CBMERP in their existing ERP system.
- 96% of the participating SMEs do not have updated ERP systems in their companies and willing to implement ERP. This indicates that is huge scope for CBMERP.

6.20.3 Findings from descriptive statistics and box plot

- All the parameters indicate that the respondents are neutral, on an average but the score range between 3.5 -4.5. This implies that they mostly agree with them.

- Training program parameters have the largest standard deviation which can be omitted because the data size was small with largest dispersion.
- Skewness/Kurtosis Ratio, normal distribution curve and box plot support confirms that the data is normally distributed.

6.20.4 Findings from inferential statistics

- Paired sample test, shows that variables which have a significance value less than 0.05 at 5% level of significance can be rejected for null hypothesis. Therefore, it can be concluded that relationship between the CBMERP benefits parameters and CBMERP benefits other than top support management – benefits and training and education – benefits.
- From the independent sample test, for strategy 1- company strategy led to CBMERP, strategy 3- top management innovation and new ideas, top management support 1- worth investment, challenge 1-lack of idea, information and experience, business process reengineering 2 - revised business process, employee participation 2-integrated CBMERP implementation team and training and education 1 - new skill set, the Levene's test the level of significance is $p < 0.01$. the assumption that the population variance was rejected. For other questions, the level of significance p is greater than 0.01, which indicates that the equal variance is assumed and t-test should be used.
- From the chi-square test, it was established that all the variables under statutory welfare measures had significance value less than 0.05 at 5% level of significance; hence null hypothesis was rejected. It was concluded that parameters were satisfied with CBMERP measures in SMEs which participated in the validation study.

- Correlation analysis shows that there was a significant correlation (at the $p<0.001$ level) between all CBMERP parameters and CBMERP implementation benefits other than company strategy measures parameter.

6.20.5 Findings from Data Reliability Analysis

- Total data and parameters that produced Cronbach's alpha were 0.855 and 0.877 which indicate a high level of internal consistency for selected scale with specific samples.

6.20.6 Findings from Factor Analysis

- The Kolmogorov-Smirnov test of normality showed a significant value for all the variables under consideration as less than 0.05 at 5% level of significance. Therefore, the null hypothesis was accepted and justified to perform factor analysis.
- From the Factor analysis, CBMERP parameters measure comprises seven components, for the selected 29 variables with only 73.562 % variance.

6.20.7 Findings from multiple regression analysis

- There was a positive relationship between the reliability 1 - traditional computing method, motivation 4-strategic motivation, challenge 5-not recognize benefits, project management 3 user participation and commitment, motivation 1-financial motivation, challenge 2-limited skill and lack of time and CBMERP benefits as the positive regression coefficient. These predictors were identified to have a strong effect on the response.

6.20.8 Findings from manufacturing activities in CBMERP

- 95 professionals out of 100 responded to the valuation survey strongly agreed that companies managed to reduce downtime in manufacturing operations through application of CBMERP and 19 professionals strongly rejected in the improvement in delivery time. This indicates the need for improvement in CBMERP delivery module.

6.20.9 Findings from Gap analysis in CBMERP modules

- Feedback on PPM modules shows fewer gaps in the GAP Analysis. This indicates that, manufacturing modules function included in CBMERP are working in order and have much scope for CBMERP to be integrated in and ERP system particularly for SMEs in UAE.

Majority of manufacturing SMEs in UAE have implemented basic ERP systems or using basic ERP software in their manufacturing activities. Lack of financial support is the main reason for this weakness. They respondents expressed that having tested the CBMERP modules improved their manufacturing operations in several areas such as reduction in downtime, improved quality and reduction in production lead time. They also expressed that there is some drawback in CBMERP delivery time module which is not well integrated with other functions.

CHAPTER 7
CONCLUSION, RECOMMENDATIONS, LIMITATIONS, FURTHER STUDY AND CONTRIBUTION

7.1 Conclusion

The purpose of this thesis was to examine factors that influence the selection and adoption of cloud based ERP in UAE manufacturing companies and develop a conceptual framework (CBMERP) to enhance existing ERP systems and optimise manufacturing performance in UAE SMEs.

ERP systems provide great benefits to companies. Like many other developing countries, SMEs in UAE face many challenges with issues related to economic, cultural and basic infrastructure which affect the manufacturing performance significantly. Cloud ERP is an approach to enterprise resource planning (ERP) that makes use of cloud computing platforms and services to provide a business with more flexible business process transformation. SMEs have changed rapidly their business operations to achieve competitive advantage. Engaging with cloud based ERP is the latest trend to achieve a) how they innovate, b) improve the speed at which they deliver products and services, c) improve their overall resiliency and d) how they engage with customers. Manufacturing organisations in the Middle East realise that there is an urgent need for understanding ERP adoption and implementation issues since ERP systems are still in the early stages in these countries. The research investigates the technological and cultural barriers that impede the adaptation and implementation of ERP successfully UAE manufacturing SMEs.

An empirical study was carried out in randomly selected companies in UK and UAE manufacturing SMEs that use different types of cloud and non-cloud based

ERP systems. The study provided a sound understating of ERP practices deployed in manufacturing SMEs in UK and UAE. Based on the empirical analysis, critical success factors were identified and a unique cloud based manufacturing ERP framework (CBMERP) was developed that is more suitable to UAE SMEs with specific emphasis on manufacturing functions, faster deployment, access to advanced technologies and more ease of use.

The proposed model was validated involving an empirical analysis in selected SMEs in UAE. The study was based on the views of company participants who were experts in manufacturing operations including directors, managers, engineers, supervisors, quality control, shop floor and IT staffs. The validation took a shape of descriptive study and attempts to explain the improvement in the manufacturing operations. The study explored the relevant training and cultural issues and tools to implement the unique framework suitable for manufacturing organization within the UAE states. A total of 50.9 % of the respondents returned the survey instrument which was developed for the study. Data analysis, including t-test and, chi-square test was conducted at 0.05 level of significance. Unlike UAE, majority of the UK companies who took part in the survey had ERP system implemented within the last two years or less.

This research shows that SMEs in UK and UAE are prepared to implement cloud based ERP (CBMERP) in their companies to achieve better business success. Unlike UAE, ERP cloud services are widely used for inventory control and supply chain management activities in the UK SMEs. Both UAE and UK SMEs prefer resource implication for cloud services through training and materials. Study also identified that UK and UAE SMEs are keen to implement CBMERP to improve their manufacturing performance as it scored higher on the performance of overall manufacturing (t-test, $p < 0.05$), apparently more positive impacts on wide range of manufacturing processes (t-test, $p < 0.05$). Analysis shows that there is innovative climate (t-test, $p < 0.05$) in UAE SMEs indicating the willingness to adopt cloud ERP. Study also recognized that the main issue during CBMERP implementation in UAE SMEs were are high cost and resistance to change from employees. Other concerns identified whilst incorporating CBMERP were lack of financial support and employee's awareness of up-to-date knowledge in tools, techniques and knowledge. Selection of ERP cloud vendor was is purely based on reputation in both nations.

Both in UK and UAE SMEs, success factors for cloud based ERP were identified as management leadership, employee involvement, training and education, organizational ability, working environment, cultural and motivational factors. The influence of management decisions and cultural factors were found to have major influence in CBMERP in UAE SMEs. Results of t-test on ERP cloud success implementation factors in UK and UAE SMEs indicate that there was no significant difference between sample and population mean. Analysis of paired t-test in management leadership, employee involvement and education and training showed that the leadership in management has no significance in both UK and UAE companies. This is understandable since the leadership culture of executives in UAE differs from UK management. Employee involvement, education and training have significance and relationship which indicates that the mind-set of the employees of UK and UAE manufacturing SMEs were appear to be similar.

Correlation test carried out for the success factors for UK SMEs indicates that cultural and motivational factors have positive correlation with ERP cloud success. But this contradicts with UAE SMEs, where organizational ability, training and education, cultural factors and management leadership showed negative correlation with success of cloud ERP implementation. The overall performance for ERP cloud implementation success was calculated using balance score card method and results were found to be 0.658 for UAE SMEs and 0.742 for UK SMEs. This falls within 'good' category. Performance evaluation was cited as critical success factor (Al-Mashari et al., 2003) as it provides guidance for ERP implementation decisions. But none of the ten SMEs took part in validation study regarded performance evaluation of cloud ERP as a major critical success factor.

Analysis also indicates that success of the cloud ERP implementation in UK SMEs was highly influenced by motivational factors. Whereas in UAE SMEs, success was highly relied on cultural factors and working environment. Multiple regression analysis indicated that motivational factors were the major influencing parameters for the success of cloud based ERP cloud implementation. Study revealed that education and training have negative influence on the success CBMERP implementation. These findings were supported by the descriptive statics which showed a score ranged between 3.5-4.5. The study highlighted that changes in work ethics and climate for innovative atmosphere were considered to be essential requirement for the success of CBMERP. Functional reasons were mentioned by majority of employees as the main motivation for considering adoption of CBMERP.

Paired sample test and rejection of null hypothesis and analysis of inferential statistics (significance value less than 0.05 ant 5% level of significance) confirmed that there was a strong relationship between the CBMERP benefits parameters and CBMERP benefits other than top support management–benefits. Chi-square test established that all the variables under statutory welfare measures had significance value less than 0.05 at 5% level of significance concluding that all the parameters in the CBMERP framework were satisfied.

Correlation analysis showed that there was a significant correlation ($p<0.001$ level) between all CBMERP parameters and implementation benefits other than company strategy measures parameters. The Kolmogorov-Smirnov test of normality showed a significant value for all the variables under consideration as less than 0.05 at 5% level of significance; hence justified the accuracy of the analysis. GAP analysis of all PPM modules integrated in CBMERP were in working order and convinced that there is much scope for CBMERP integrated ERP system particularly for SMEs in UAE.

In the ranking of critical success factors that were considered for successful cloud ERP, there were not much difference in statistical significant between companies in UAE and UK SMEs. Top management support and involvement were perceived as major critical success factors for CBMERP implementation by majority of the respondents. Almost all respondents who took part in the validation study expressed satisfaction with the functions and output of the manufacturing modules integrated in CBMERP. Training and education in IT and cloud computing were also considered as a critical requirement for manufacturing employees. Comparison in ranking of critical success factors for CBMERP shows least statistical significant difference UAE companies. Decision to implement an CBMERP system was usually made by top management in many SMEs. Study highlighted that inefficient flow of information across internal and external boundaries of the organisation to be the major obstacle for the success of cloud ERP in UAE SMEs.

7.2 Recommendations

The author suggests the following recommendations should be taken into consideration before integrating the CBMERP model with an existing ERP system:

- Identify business objectives and establish business goals to ensure the match of output from CBMERP.
- Chose only the features that you require and avoid installing a whole Cloud ERP package if there is no need for it. Select the most appropriate ERP software that suits the company's specific needs.
- Determine a strategy for adopting CBMERP and have a full commitment from top management.
- Understand and be prepared for the fact that every process in a company will be affected by CBMERP implementation particularly to cope with integration of several major and sub modules in the ERP system.
- SMEs must have a clear focus on all functions in the ERP system. Understanding of the concepts of CBMERP modules and good planning prior to implementation are essential to achieve the full benefits of CBMERP model.
- Evaluate all manufacturing and business processes and have accurate and reliable data ready before integrating CBMERP with the existing ERP system. This will prevent unnecessary cost and shorten the manufacturing lead-time.
- One of the significant problems in ERP integration is data exchange. The CBMERP system must be able to read and write data to other applications the company already using.
- Before integrating CBMERP into the IT process, it is important to include ease of integration as one of the selection criteria. This requires knowing

which applications you want your new ERP system to integrate with and what data formats will be necessary for interoperability.

- Another problem with CBMERP integration is updating the existing ERP system. This means more modifications and custom programming to keep the system working effectively.
- Incremental adoption of cloud ERP modular design is advisable.
- Appraise cost estimates prior to committing to CBMERP installation. Clear resource planning will help to determine the budget required.
- Allocate a budget for education and training program to educate the workers to understand and use CBMERP framework.
- Prevent resistance to change by assuring employees that implementation of CBMERP will not threaten their jobs. Identify changes that will impact the workgroup in the organisation and how the new system will affect the job roles.
- Provide training to employees to reinforce the specifics of what they already know, understand and how to work with the new system.
- Consider the limitations of the organisation such as constraints on HR, financial resources, specialist skill requirement and time when developing implementation plan for CBMERP.
- When developing an implementation strategy, take into account the particular limits of the company, such as availability of human resources, of specialized expertise and financial resources.
- Ensure that employees understand the range of choices offered by CBMERP package. This can be achieved by appointing an effective team leader.
- Set up a project budget with enough reserves to cover unforeseeable cost.

7.3 Limitation of the study

This study focused on the general aspects of cloud based ERP systems and CBMERP. The findings may not be specific enough to assess the full benefits of integration of certain modules.

- The varying level of knowledge, learning and experience that may affect the potential capabilities of CBMERP were not considered in this research.
- Results and evaluation of hypotheses were based purely on survey with limited face-to-face interview with the participants, observation and secondary data.
- The complexity and issues in integrating the CBMERP framework module. with the existing ERP system were not examined in this study. Other complexity is the cost and compatibility. SMEs operating on tight budget often implement small-box or open source ERP solutions, which rarely include a well-standardized integration interface. This often means a customized interface must be built, or additional add-on modules must be purchased. For a production manager who works traditional way, it can be difficult to be convinced that the investment in such software is a major risk.
- This study relied on data gathered from company's managers, directors, workers, supervisors and workers. Due to variety of group with different knowledge and experience in ERP, there is a possibility for bios, since each respondent has a different view on company's business performance.

7.4 Suggestions for further study

Considering the complexity of cloud based ERP implementation, the following suggestions for further research are suggested:

- Explore the differences in factors affecting CBMERP implementation including motivation, work ethics and culture.
- Examine the effect of CBMERP implementation approach used by UAE SMEs to achieve full potential of the model.
- Investigate if the factors that affect CBMERP implementation differ by the type of module that a SME is implementing.
- Considering the complexity in data integration in ERP systems, develop a implementation strategy for integrating CBMERP with an existing ERP system.
- Future research is recommended to gather a balanced feedback from different participants such as suppliers, customers, regulators and industrial experts and ERP consultants

7.5 Contribution

Adoption of cloud based ERP is very limited in UAE manufacturing SMEs. There is not much empirical study has been carried out in this field to identify the barriers for cloud ERP implementation in the Middle East companies. The purpose of studying this topic was to examine factors that influence the selection and adoption of cloud based ERP in UAE manufacturing companies. A comparative study was carried out in UK and UAE SMEs to evaluate the differences in the perception and application of cloud based ERP. Through extensive statistical analysis, the technological and cultural barriers that impede the adaptation and implementation of cloud based ERP successfully in UAE companies were recognised. This research contributed to the existing body of knowledge by identifying that a significant gap exists in the factors that influence the success of cloud based ERP system in UAE manufacturing SMEs. It addressed this gap by providing a conceptual framework of the influential factors involved in the success of a cloud based ERP model. Various unique success factors that are more appropriate to UAE manufacturing SMEs with specific emphasis on, manufacturing elements, faster deployment, access to advanced technologies and more ease of use were considered in the CBMERP. Validation study of CBMERP revealed that UAE SMEs which experimented the proposed model achieved improvement in their manufacturing operations through shorter cycle times, reduced manufacturing costs, improved supply chain management practices and shorter delivery times

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APPENDIX

A1 QUESTIONAIRE 1

Survey on ERP System to Optimize the Business Process in Through Cloud Application in Manufacturing SMEs

This is a survey to collect your views on the practices on ERP in your organisation. Please spare few minutes to respond to the survey by simply rating **(putting a tick mark)** each statement. This will help us to identify where improvements can be made so as to optimize the business process.

Basic Details

Basic details

Name and location (town) of the SMES:

What is the position level you hold in the company?

☐ Top Management ☐ Senior Management ☐ Middle Management ☐ Junior Management

No. of Employee in your SMES:

☐ Less than five ☐ 6-20 ☐ 21-35 ☐ 36- 50 ☐ more than 50

Does your company use any sort of Enterprise Resource Planning (ERP) system?

☐ Yes ☐ No

When did your company start/Plan Cloud Techniques with ERP?

☐ Less than one year ☐ 1-2 year ☐ 2.1-3 year ☐ 3.1-4 year ☐ more than 4 years

Rate the potential advantage to be gained in implementing if Cloud Techniques applied to existing ERP

☐ Organizing/Integrating Data ☐ Cost Saving ☐ Accessibility ☐ Productivity ☐ Reporting

The main criteria for implementing ERP system in your organization was

☐ Technical ☐ Strategic ☐ Functional ☐ Financial ☐ others

How was the ERP systems vendor selected?

☐ Decision by senior management ☐ Based on cost ☐ Based on reputation ☐ Systematic Selection Process

If opting for cloud application, what type of cloud service will suit your organisation?

☐ Infra structure as a service (IaaS) ☐ Platform as a service (PaaS) ☐ Software as a service (SaaS)

What is the main challenge identified prior to ERP implementation?

☐ Poor planning ☐ weak project team ☐ resistance to change ☐ weak risk strategies

What is the main challenge identified prior to implementation?

☐ Underestimating time and resources allocated ☐ Lack of management commitment ☐ others

What is the main issue you may face in incorporating cloud computing in your ERP system

☐

Importance rating

Below is a list of requirements that may be **important** when implementing and practicing Cloud Techniques with ERP. Please indicate **how important each one** is to you by rating **(put a tick mark)** each of the listed factors on a scale from 1 – 5 (1 is not at all important and 5 is extremely important).

How important to you each of the following?		Not at all important	Slightly important	Important	Very important	Extremely important
A.	**MANAGEMENT LEADERSHIP**					
A1	Commitment and support of for ERP	☐	☐	☐	☐	☐
A2	Empowering of employees by management	☐	☐	☐	☐	☐
A3	Provision of sufficient resources for Cloud ERP	☐	☐	☐	☐	☐
B.	**EMPLOYEE INVOLVEMENT**					
B1	Familiarities on ERP module, Data Manipulation	☐	☐	☐	☐	☐
B2	Familiarities on Well Known ERP cloud deployment	☐	☐	☐	☐	☐
B3	Use of self-assessment tools to identify and remedy weaknesses for ERP cloud technologies in future	☐	☐	☐	☐	☐
	C. TRAINING AND EDUCATION					
C1	Will your provide employees training on Cloud ERP concepts	☐	☐	☐	☐	☐
C2	Provision of continuous learning through training and education	☐	☐	☐	☐	☐
	D Business Process – Production Planning Stage	**Poor**	**Fair**	**Good**	**Very Good**	**Excellent**
D1	Selection of raw material/semi-finished product flow (visibility) on current ERP	☐	☐	☐	☐	☐
D2	Implement process innovation for cloud ERP	☐	☐	☐	☐	☐
D3	Implement design innovation based on cloud ERP	☐	☐	☐	☐	☐

D4	Provide planning to upgrade systems for cloud ERP	☐	☐	☐	☐	☐
	E Business Process – Production Monitoring Stage					
E1	Measuring & Monitoring level of production process through ERP	☐	☐	☐	☐	☐
E2	Capturing information requirement during Product Development & Quality improvement through ERP	☐	☐	☐	☐	☐
	F Business Process – Production Control Stage					
F1	Enable better performance to multitasks	☐	☐	☐	☐	☐
F2	Automatic and incremental upgrade with system information accessed anywhere through web browser	☐	☐	☐	☐	☐
	G Production System Reliability through ERP Techniques					
G1	Intercept	☐	☐	☐	☐	☐
G2	Consistency	☐	☐	☐	☐	☐
G3	Clarity	☐	☐	☐	☐	☐
G4	Easy Work Assign	☐	☐	☐	☐	☐
	H Barriers to implement cloud ERP Techniques					
H1	Information Transparency	☐	☐	☐	☐	☐
H2	Data Security	☐	☐	☐	☐	☐
H3	Integration Difficulties	☐	☐	☐	☐	☐
H4	Individual Customization	☐	☐	☐	☐	☐
	I Organization ability for ERP Cloud Techniques					
I1	Willingness to change	☐	☐	☐	☐	☐
I2	Willingness to adopt new technologies	☐	☐	☐	☐	☐
I3	Readiness for technological changes	☐	☐	☐	☐	☐
	K ERP with WORK ENVIRONMENT					
K1	Provision of pleasant working environment	☐	☐	☐	☐	☐
K2	Adaptation of employee satisfaction initiatives (Suggestion Schemes, Profit sharing etc)	☐	☐	☐	☐	☐

L ERP with Culture Factor

L1	Good result are good	☐	☐	☐	☐	☐
L2	Deadlines are flexible	☐	☐	☐	☐	☐
L3	There are sufficient training programmes in the company	☐	☐	☐	☐	☐
L4	Policies and Procedures are formal	☐	☐	☐	☐	☐

M ERP with Motivational Factor

M1	Replace the legacy system	☐	☐	☐	☐	☐
M2	Ease of upgrading system	☐	☐	☐	☐	☐
M3	Simply and standardize with suppliers and customers	☐	☐	☐	☐	☐
M4	Link global activities	☐	☐	☐	☐	☐

Which of the following functions are strategically integrated in your company's for future Cloud ERP project?

☐ Accounting ☐ CRM ☐ Inventory ☐ Quality Management ☐ SCM ☐ HRM ☐ Planning

What are the resources implications to implementing Cloud ERP?

☐ New equipment
☐ New technology resources
☐ Training
☐ Materials
☐ Funding
☐ Additional man power
☐ Additional work hours
☐ Additional space

a. Do you see a need for cloud techniques in ERP?

☐ Yes ☐ No ☐ Don't Know

b. What do you think of a new improvement methodology that combines benefits of cloud techniques in ERP?

☐ Good approach ☐ Bad approach ☐ Don't think it will make a difference ☐ Don't know

c. Do you think your company will be interested in using the new improvement methodology that combines cloud techniques with ERP?

☐ Yes ☐ No ☐ Will wait until success is proved.

Thank you for taking part in this survey. Your contribution and data you provided are important to us and will remain confidential

A2 QUESTIONAIRE 2

Survey on ERP System to Optimize the Business Process in Through Cloud Application in Manufacturing SMEs

This is a survey to validate the cloud-based ERP (CBMERP) model. Which you have tested in your company to improve your manufacturing performance. Your views will help us to identify manufacturing areas where improvements have achieved find out the strengths and weaknesses of CBMERP.

Demographics of the Respondents

Company Name: *Location:*

1. What is your job title?

(a) Manufacturing Engineer (b) ERP analyst (c) Technical specialist (d) Director, Manager, Supervisor (e) Systems Engineering/Support (f) others

2. Approximate number of employees?

(a) Less than 100 (b) 101-200 (c) 201- 400 (d) 401 and above

3. Annual total IT budget?

(a))< £0.1M (b) 0.11M -0.30M (c) 0.31M -0.40M (d) 0.41M -0.50M

4. Have you implemented or is your organization in the process of implementing a manufacturing module with cloud ERP solution:
(a) Yes (b) No

CBMERP improved manufacturing operations in the following areas: Tick Yes or No

Manufacturing activity	**Yes / No**
Production planning	
Material management	
Reduction in work-in-progress	
Increase in productivity	
Reduction in bottleneck	
Reduction in downtime	
Lean operations	
Quality management	

Reduction in inventory level	
Streamlining manufacturing processes	
Product management	
Integration of various production processes	
Maintenance activities	
Shorter delivery time	

Rank the critical success factors for CBMERP implementation

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Top management support					
Project management					
Business process reengineering					
Project schedule and planning					
Appropriate personnel, skills and expertise					
User acceptance					
Crisis management					
User participation					
Change management					
Organizational fit and adaptability					
Employee motivation, support and consideration					
Corporate culture and work climate					

Parameter 1: Company strategy

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Company strategy led to CBMERP					
CBMERP let to strategy					
Top management is committed to innovation and new ideas					

Parameter 2: Top management support

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)

Management considers the CBMERP system worth the investment					
We have strong top management support					

Parameter 3: Motivation for CBMERP

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
The following are underlying motivations of implementing CBM ERP: Financial (Profit, revenue etc) Operational (Business process etc) Technological (IT Platform, software etc) Strategic (Information, planning, competitors etc)					

Parameter 4: CBMERP Challenges

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Lack of ideas, information, and experience					
Limited skill and expertise and lack of time					
Problem with attitudes, employee resistance to system					
Lack of support structure					
Benefits of the system not recognizable					
CBMERP system too complex					
Integration of different types of data was a big challenge					

Parameter 5: Business process reengineering

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Company IT skills were updated to cope with CBMERP					
Business processes were revised for improvements than just applying the new system to existing processes					

Parameter 6: Project management

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
We have Qualified staff, skills and expertise We have Sufficient control system, monitoring and feedback We have high numbers user participation and commitment Project completed on time					

Parameter 7: Employee participation

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
All the employees in the company were involved in consultation of CBMERP implementation project					
Manufacturing workers were included in the CBMERP implementation team					

Parameter 8: Reliability of CBMERP

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
CBMERP is more reliable than traditional computing methods					
CBMEP has more functionality/features than the previous system					

Parameter 9: Training of education

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
CBMERP implementation necessitated requirement of new skill set among employees in terms of computer proficiency					
Fair amount of training programs have been introduced for employees to learn CBMERP					
Training programs are easily understood					

Parameter 10: CBMERP benefits

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Improved interaction with suppliers					

Improved interaction with customers					
Faster information response time					
Lower direct operation costs					
All the major elements manufacturing function were included					
Increased interaction across the organisation					

Thank you for taking part in this survey. Your contribution and data you provided are important to us and will remain confidential

A3 Paired Sample Test for UK and UAE

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Employee Involvement UK – Employee involvement UAE	.47500	.78598	.17575	.10715	.84285	2.703	19	.014

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 2	Management leadership UAE – Management leadership UK	-.06667	.82788	.18512	-.45412	.32079	-.360	19	.723

A4 Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 3	Training and Education UK – Training and Education UAE	.75000	.86603	.19365	.34469	1.15531	3.873	19	.001

A5 Correlation Analysis Between UAE Parameters

Correlations UAE

		Success of ERP implementation	Management leadership	Employee involvement	Training and Education	Organization ability	Work Environment	Culture Factor	Motivation Factor
Success of ERP implementation	Pearson Correlation	1	-.558*	.153	-.580**	-.473*	.002	-.632**	.275
	Sig. (2-tailed)		.011	.519	.007	.035	.994	.003	.241
	N	20	20	20	20	20	20	20	20
Management leadership	Pearson Correlation	-.558*	1	-.076	.627**	.355	-.045	.601**	-.075
	Sig. (2-tailed)	.011		.749	.003	.124	.852	.005	.753
	N	20	20	20	20	20	20	20	20
Employee involvement	Pearson Correlation	.153	-.076	1	.007	-.244	-.370	-.286	.655**
	Sig. (2-tailed)	.519	.749		.978	.300	.109	.222	.002
	N	20	20	20	20	20	20	20	20
Training and Education	Pearson Correlation	-.580**	.627**	.007	1	.323	.225	.416	.042
	Sig. (2-tailed)	.007	.003	.978		.164	.341	.068	.860
	N	20	20	20	20	20	20	20	20
Organization ability	Pearson Correlation	-.473*	.355	-.244	.323	1	.452*	.466*	-.517*
	Sig. (2-tailed)	.035	.124	.300	.164		.046	.038	.020
	N	20	20	20	20	20	20	20	20
Working Environment	Pearson Correlation	.002	-.045	-.370	.225	.452*	1	.035	-.195
	Sig. (2-tailed)	.994	.852	.109	.341	.046		.882	.409
	N	20	20	20	20	20	20	20	20
Culture Factor	Pearson Correlation	-.632**	.601**	-.286	.416	.466*	.035	1	-.364
	Sig. (2-tailed)	.003	.005	.222	.068	.038	.882		.115
	N	20	20	20	20	20	20	20	20

Motivation Factor	Pearson Correlation	.275	-.075	.655**	.042	-.517*	-.195	-.364	1
	Sig. (2-tailed)	.241	.753	.002	.860	.020	.409	.115	
	N	20	20	20	20	20	20	20	20

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

		Success of ERP implementation	Management leadership	Employee involvement	Training and Education	Organization ability	Work Environment	Culture Factor	Motivation Factor
Success of ERP implementation	Pearson Correlation	1	-.183	.173	-.397	.032	.372	.436	.437
	Sig. (2-tailed)		.439	.467	.083	.894	.107	.055	.054
	N	20	20	20	20	20	20	20	20
Management leadership	Pearson Correlation	-.183	1	-.254	.044	-.080	-.223	-.472*	-.086
	Sig. (2-tailed)	.439		.280	.854	.738	.345	.036	.717
	N	20	20	20	20	20	20	20	20
Employee involvement	Pearson Correlation	.173	-.254	1	-.304	.262	-.018	-.233	.276
	Sig. (2-tailed)	.467	.280		.193	.264	.939	.323	.239
	N	20	20	20	20	20	20	20	20
Training and Education	Pearson Correlation	-.397	.044	-.304	1	.567**	-.386	.187	-.063
	Sig. (2-tailed)	.083	.854	.193		.009	.093	.429	.790
	N	20	20	20	20	20	20	20	20
Organization ability	Pearson Correlation	.032	-.080	.262	.567**	1	.006	-.003	.278
	Sig. (2-tailed)	.894	.738	.264	.009		.979	.992	.235
	N	20	20	20	20	20	20	20	20
Working Environment	Pearson Correlation	.372	-.223	-.018	-.386	.006	1	.289	.324
	Sig. (2-tailed)	.107	.345	.939	.093	.979		.216	.164
	N	20	20	20	20	20	20	20	20
Culture Factor	Pearson Correlation	.436	-.472*	-.233	.187	-.003	.289	1	.133
	Sig. (2-tailed)	.055	.036	.323	.429	.992	.216		.577
	N	20	20	20	20	20	20	20	20
	N	20	20	20	20	20	20	20	20

*Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

A6 Balanced Score Data for UK and UAE MSMES ERP success Performance

Implementation Success Factor	Average Response Score of UAE MSMES Matrix	Average Response Score of UK MSMES Matrix	Average Weight age	Weight age Mean	Score Matrix of UAE MSMES	Score Matrix of UK MSMES	Implementation of Success Performance of UAE MSMES	Implementation of Success Performance of UK MSMES
Management Leadership	3.78	3.85	5	0.143	0.756	0.770	0.108	0.110
Employee Involvement	3.05	3.52	5	0.143	0.610	0.704	0.087	0.101
Training and Education	2.97	3.72	5	0.143	0.594	0.744	0.085	0.106
Organization ability	3.1	3.96	5	0.143	0.620	0.792	0.089	0.113
Working environment	2.82	3.35	5	0.143	0.564	0.670	0.081	0.096
Culture Factor	3.75	3.8	5	0.143	0.750	0.760	0.107	0.109
Motivational Factor	3.53	3.75	5	0.143	0.706	0.750	0.101	0.107
		Overall Implementation of Success Performance					**0.658**	**0.742**

EXTERNAL AND STRATEGIC DEVELOPMENT SERVICES
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UEL University of East London

10 June 2016

Dear Mohammed,

Project Title:	**Develop a novel framework to apply cloud computing techniques in ERP system to optimise business processes – a case study approach in Gulf Corporation Council (GCC) Manufacturing SMES**
Principal Investigator:	**Dr Subramaniam Arunachalam**
Researcher:	**Mohammed Alsadi**
Reference Number:	**UREC 1516 112**

I am writing to confirm the outcome of your application tothe University Research Ethics Committee (UREC), which was considered by UREC **on Wednesday 18 May 2016.**

The decision made by members of the Committee is **Approved**. The Committee's response is based on the protocol described in the application form and supporting documentation. Your study has received ethical approval from the date of this letter.

Please note the UREC Application Form for ethical approval has been revised. For future applications please use the revised application form which can be found on: https://uelac.sharepoint.com/ResearchInnovationandEnterprise/Pages/Ethics.aspx

The Committee would like to commend you on the presentation of this application for ethical approval.

Should you wish to make any changes in connection with your research project, this must be reported immediately to UREC. A Notification of Amendment form should be submitted for approval, accompanied by any additional or amended documents: http://www.uel.ac.uk/wwwmedia/schools/graduate/documents/Notification-of-Amendment-to-Approved-Ethics-App-150115.doc

Any adverse events that occur in connection with this research project must be reported immediately to UREC.

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POSITIVE ABOUT DISABLED PEOPLE
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Approved Research Site

I am pleased to confirm that the approval of the proposed research applies to the following research site.

Research Site	Principal Investigator / Local Collaborator
University of East London and survey	Dr Subramaniam Arunachalam

Approved Documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
UREC application form	2.0	3 June 2016
Participant Information Sheet	2.0	3 June 2016
Consent Form	2.0	3 June 2016
Survey	1.0	3 May 2016

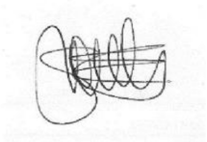
Approval is given on the understanding that the UEL Code of Practice in Research is adhered to.

The University will periodically audit a random sample of applications for ethical approval, to ensure that the research study is conducted in compliance with the consent given by the ethics Committee and to the highest standards of rigour and integrity.

Please note, it is your responsibility to retain this letter for your records.

With the Committee's best wishes for the success of this project.

Yours sincerely,



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