The Process and Impact of Implementing Enterprise Resource Planning (ERP) System in Manufacturing Enterprises in India

Thesis

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By

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Declaration

I, **SHIJA T**, do hereby declare that this thesis entitled "THE PROCESS AND IMPACT OF IMPLEMENTING ENTERPRISE RESOURCE PLANNING SYSTEM [ERP] IN MANUFACTURING ENTERPRISES IN INDIA**"** submitted to the University of Calicut in partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy in Commerce is a record of the bona fide research work done by me, under the supervision and guidance of **Dr. P MOHAN**, Professor (Rtd.), Department of Commerce and Management Studies, University of Calicut. I further declare that this thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title or recognition.

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Certificate

This is to certify that the thesis entitled "THE PROCESS AND IMPACT OF IMPLEMENTING ENTERPRISE RESOURCE PLANNING [ERP] SYSTEM IN MANUFACTURING ENTERPRISES IN INDIA" submitted to the University of Calicut in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy in Commerce, is a bona fide record of research work carried out by Ms. **SHIJA T.** under my supervision and guidance and no part of this thesis has formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title before. She is permitted to submit the thesis to the University for evaluation.

University of Calicut, **Dr. P. MOHAN**

Date: 31-01-2023

To my daughters, Neomi and Aylin...

Your were always so understanding for all the times I couldn't be there when you needed me. I hope we will have many years of great times together...

Love you both...

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LIST OF ABBREVIATIONS

AHP	:	Analytical hierarchy Process
ANP	:	Analytical Network Process
ATR	:	Asset Turnover Ratio
AVE	:	Average Variance Extracted
B2B	:	Business-to-Business
B2C	:	Business to Consumer
BPR	:	Business Process Reengineering
BSE	:	Bombay Stock Exchange
CEO	:	Chief Executive Officer
CFA	:	Confirmatory Factor Analysis
CGS	:	Cost of Goods Sold
CMIE	:	Centre for Monitoring Indian Economy Pvt. Ltd
CNTS	:	Consultancy Services
CRM	:	Customer Relationship Management
CSF	:	Critical Success Factor
CTE	:	Consultant Evaluation
CTL	:	Customisation Level
CTS	:	Consultant Scalability
CTV	:	Consultant Viability
DMG	:	Data Migration
DNMK	:	Decision Making
DRG	:	Development Research Group
DTR	:	Debtors Turnover Ratio
E^2RP/ERP II	:	Extended Enterprise Resource Planning
EBIT	:	Earnings Before Interest and Tax
EDI	:	EDI Electronic Data Interchange

EPV	:	ERP Package Vendor
ERP	:	Enterprise Resource Planning
ERPS	:	Enterprise Resource Planning System
EUT	:	End User Training
FAT	:	Fixed Asset Turnover Ratio
FCM	:	Fuzzy Cognitive Maps
FNP	:	Financial Performance
FNS	:	Functional Scope
HOC	:	Higher Order Construct
HTMT	:	Heterotrait-monotrait Ratio of Correlations
IMPA	:	Implementation Approaches
INLO	:	Inbound Logistics
IoT	:	Internet of things
IS Module	:	Industry-Specific Module
IS	:	Information System
ISR	:	Information System Readiness
IT	:	Information Technology
ITR	:	Inventory Turnover Ratio
KCSF	:	Key Critical or Success Factors
KPI	:	Key Performance Indicators
K-S test	:	Kolmogorov-Smirnov test
LOC	:	Lower Order Construct
LVS	:	Latent Variable Score
MIS	:	Management Information System
MRP II	:	Manufacturing Resource Planning
MRP	:	MRP Material Requirement Planning
MS Excel	:	Microsoft Excel

MSME	:	Micro, Small and Medium Enterprise
NS	:	Net Sales
NSE	:	National Stock Exchange
OGCB	:	Organisational Capability
OGR	:	Organisational Readiness
OPXL	:	Operational Excellence
OTLO	:	Outbound Logistics
PC	:	Project Cost
PHS	:	Physical Scope
PJS	:	Project Scope
PLS-SEM	:	Partial Least Squares-Structural Equation Modelling
PP	:	Project Performance
PQ	:	Project Quality
PROMETHEE	:	Preference Ranking Organisation Method for Enrichment Evaluation
PT	:	Project Time
QA	:	Quality Assurance
RMO	:	Resource Mobilisation
ROA	:	Return on Asset
ROI	:	Return on Investment
ROS	:	Return on Sales
SAPPLM	:	System Analysis Program Development Product Lifecycle Management
SCM	:	Supply Chain Management
SEM	:	Structural Equation Modelling
SG&A	:	Selling General and Administrative Expenses
STG	:	System Testing
STIM	:	Strategic Impact

STU	:	System Upgradation
SWR	:	Software Readiness
TPS	:	Transaction Processing System
TTF Theory	:	Task Technology Fit Theory
UK	:	United Kingdom
VDE	:	Vendor Evaluation
VDS	:	Vendor Scalability
VDV	:	Vendor Viability
VIF	:	Variance Inflation Factor

Chapter One

THE PROCESS AND IMPACT OF IMPLEMENTING ENTERPRISE RESOURCE PLANNING SYSTEM IN MANUFACTURING ENTERPRISES IN INDIA

1.1 Introduction

The last few decades have witnessed an unprecedented and astronomical growth in business all over the world. Information technology (IT) has played a pivotal role in this transformation by expanding business and industry in the global economy, especially by taking them to remote and hitherto obscure parts of the globe. If the presence of IT was largely confined to accounting and ancillary roles in the 1960s, it began to be prominent in forecasting sales, taking orders, procurement and distribution of products in the 1980s. In India, 1990s marked the beginning of the widespread application of Information System (IS) in business, and its allied segments.

The Information System has transmuted from a mere operational tool into a sophisticated management instrument over the years in meeting and overcoming new, and often daunting, challenges faced by organizations. The amazing strides in software, hardware and overall communication networks have redefined the very concept and functions of Information System. Information System can be broadly classified into three by Mcafee (2006), Functional Information System (spread sheet, word processors, computer aided design and statistical software), Network Information System (e-mail, instant messaging, blogs and groupware) and Enterprise Information System (Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Supply Chain Management (SCM)). This study concentrates on ERP packages of enterprises Information System as its role is very critical in almost every organisation.

Hwang (2011) defined ERP implementation as a company's activities to adapt, modify, and integrate the information flow and business processes essential to serve different departments and its functions with the use of IT architecture that gathers the data and save them in real time. Information got a huge role in converting the uncertainties into opportunities as the contemporary business environment is fraught with uncertainty of a high order. Thus, the organisations are considering information as the biggest resources for its survival and successful growth and they are managing the abundance of information on a daily basis. This includes from the very basic requirements of the organisation like inbound logistics, outbound logistics and other material management operations, for managing the production, for managing the finance and for Human Resource Management to the very upper strategic operations of the business like decision making, Research and Development, project management, Customer Relationship Management and for adopting different strategies to survive in the competitive world. While strategic goals depend more on external and futuristic information, operational goals have fed mostly with internal information. The real-time information enables enterprises to support the basic business operations and also the top level strategic management. It helps them to be more competitive in the fiercely competitive business environment. But this information has been spread widely across the organisation and outside the organisation. Proper integration of theses information is very significant. The ERP system is such a package designed to hilt with such integrated, highly accurate and timely information.

Thus, the ERP system is a package of software solution that it integrates diverse data flows into a virtual single database to seamlessly connect functions across the organisation. Nah et al., (2001) defined an enterprise resource planning (ERP) system as a packaged business software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance, etc.) by providing a total, integrated solution for the organization's information-processing needs. It supports a process-oriented view of the business as well as business processes standardisation across the enterprise. Among the most important attributes of ERP are its abilities to:

- Automate and integrate an organization's business processes;
- Share common data and practices across the entire enterprise; and
- Produce and access information in a real-time environment

The ERP package is an integrated modular software solution. Because of its unique design, it allows adoption of modules from different ERP providers for various functions like planning, purchasing, manufacturing, sales, marketing, finance and human resource management and also allows to integrate the entire modules with real time data accessibility, storage and data retrieval with a common database. Thus, ERP is a system which collaborates manufacturing, purchasing, inventory management, human resource, financial data etc. into a single database system.

There are different ERP packages available in the market, which include SAP, Oracle, E2 Shop System, Microsoft Dynamics, Intacct, Netsuite, Chempax, Tally, etc. They support managers in taking quick and wise decisions which can enhance the efficiency and effectiveness of management and thus can catalyse growth. Thus, ERP became the backbone of most business irrespective of national boundaries and territorial divisions.

Most of the companies are very sceptical about ERP because of the changes going to happen in their business operations, their functions, their HR practices, the fear of implementation failure and also the huge amount involved in the ERP implementation. But as the situation changes many businesses opted ERP and some of them have a feeling that it is a panacea for all their woes but sometimes it won't happen. It will lead to lack of participation, delay in operations and many other losses. The organisation needs to know that an ERP package fits into a business environment may not be suitable in another business. The selection of a package and its smooth implementation in a firm needs a lot of careful planning and management; otherwise, it will be a disaster. Many organizations faced failures due to lack of knowledge about the proper processes required in implementing ERP. Also, lack of resources to manage Information System projects and lack of synergy between the firm and the ERP system and the integration issues. This limits the implementation process. Hence, it is clear that the organisation needs to understand the different process in the ERP implementation and should require an excellent decision-making power for the proper adoption of different factors facilitates the successful implementation.

1.2 Significance of the Study

The process of ERP implementation is a very complicated and complex task of an organisation as it involves significant resource management, especially the time and money of the organisation. In spite all efforts, many implementations went into chaos and sometimes collapsed. Even large firms in developed nations faced challenges in the implementation. Some of them had massive failures also. Avoiding such problems in adopting an ERP system is a big challenge to the management and employees of any firm. Most firms nowadays are making use of the ERP system especially in the trading and manufacturing, banking and telecommunications verticals and Business Services. But the failure rate of ERP implementation pulling back the companies in implementing ERP. This may happen due to poor planning in the designing face and lack of efficiency in certain significant factors in the process of ERP implementation. Hence, it is essential to study the impact of certain factors which makes the ERP implementation success by focusing on the impact on the capability of the organisation and its financial performance. Hence, the study can provide suggestions to tackle the ERP implementation challenges.

1.3 Scope of the Study

ERP package has been widely used by the companies belonging to different sectors in India. But to confirm the real impact of Critical Success Factors (CSFs) in the process of ERP implementation, it is essential to focus on those sectors which can highlight the real outcome. Hence, the study limits its population, by selecting the manufacturing sectors in India. As per the report from Ministry of Corporate Affair, 20% of Indian companies belonging to the manufacturing sector. To get the required sample size, the study took a geographical approach to industrially populated areas. Therefore, the study purposefully chose the large and medium scale manufacturing enterprises from Maharashtra, Gujarat and Tamil Nadu, which are the top three industrial states in India. The study ignored the small-scale industrial sector, as it did not receive any data on ERP implementation from small scale sectors in the pilot test. It is essential to get a clearer response regarding the ERP implementation process and its impact. Hence, the study selected the middle level managers who have enough experience with the organisation and with the ERP. Even the respondents are the General Manager and the ERP/IT head, some of them received assistance from the Finance Manager, Production Head and Marketing Head of their organisation. The study tried to analyse the differences in the ERP implementation time and cost of different organisations. Along with the study focused on the changes in the capability of the organisation and also on the impact of ERP implementation on the financial performance of the organisation to confirm the real effect of ERP. Only listed companies were selected, so as to spool financial reports from the prowess database.

1.4 Statement of Problem

Implementation of ERP system involved a complex process. It requires large investment and proper management. The process of planning, designing, testing, and installing is continuous and that needs to be monitored closely to improve the performance of the enterprise. Every stage in the process of ERP implementation is significant. Any mismanagement in any of the stages may create serious issues and sometimes it results in ERP implementation failures. Hence, it is necessary to identify the exact requirements of the enterprise and which way these can be met, then only the firm can acquire the full benefits from the implementation. If there is proper planning, it will be fruitful and can enjoy the entire benefits of ERP implementation. Hence, it is relevant to understand the key processes involved in ERP implementation and the present study is focusing to solve the research question.

- What are the different processes adopted by the organisations for the successful implementation of ERP package?

Despite of all the benefits obtained from ERP, there are so many risks a firm needs to face while implementing such sophisticated technology. The risk are mainly due to factors like selection of wrong vendor or package, drawbacks in implementation approaches, lack of consultant support, getting a wrong consultant, issues in BPR, difficulties in mobilising resources on time, over customisation and configuration, Employees attitude, lack of management support, wrong project plan or Project team, inappropriate budget, delay in Payback period, lack of proper training, data migration issues, system testing may sometimes went wrong etc.. These risks may make budget overrun and delay in the ERP implementation time. Thus makes the ERP implementation a costly and time-consuming project. It is essential for the enterprises to take at most care from the planning to the implementation stage even in the post implementation stage. Hence, the study seeks to elicit relevant information on the factors that make the implementation successful by managing the risk elements in the CSFs. Therefore, the study needs to get answers to the research question.

- What are the factors that facilitate a successful ERP implementation on time and within budget?

Each project is a milestone in the history of the organisation. It is a strategic decision for the part of the business. As the ERP implementation project involved huge investment, the result is very crucial for a business. Once it is a failure, it will take time to recover the situation. Hence, it is relevant to study the exact impact of ERP implementation and the study tries to give light into this area of ERP implementation. Hence, the study proposes to find answers to the research question.

- What are the impacts of ERP implementation?

The study seeks to elicit relevant information in optimally implementing and utilizing ERP with the ultimate aim of enhancing the capability of the organisation and its performance.

1.5 Objectives of the Study

The basic objective of the study is to analyse the impact of ERP implementation process on the selected manufacturing sector. Hence, the study classified the objectives into four. The first objective is to identify the process of ERP implementation, which is considered as the critical factors in the implementation following with the objectives of identifying the impact of the CSFs in the process of ERP implementation.

Objective 1 : To identify the CSFs in the process of ERP implementation

Objective 2 : To identify the impact of CSFs on the time and cost of ERP implementation

Objective 3 : To identify the impact of CSFs on the capability of the organisations

Objective 4 : To identify the impact of CSFs on the financial performance of the organisations

1.6 Variables used in the Study

CSFs in the Process of ERP implementation and their impact is the core of the study. Following are the variables to measure and device the constructs for analysing the impact of ERP. The Table 1.1 indicates the independent variables used for analysing its impact on dependent variables and the Table 1.2 presents the impact variables, which is the ERP implementation project performance

I. Independent Variables

The independent variables are categorised as per the CSFs in the process of ERP implementation which is given in the Table 1.1

Table 1.1

Independent Variables: CSFs

Constructs	Variables
Project Scope (PJS)	Functional Scope (FNS) Physical Scope (PHS)
Vendor Evaluation (VDE)	Vendor Viability (VDV) Vendor Scalability (VDS)
Consultant Evaluation (CTE)	Consultant Viability (CTV) Consultant Scalability (CTS)
Software Readiness (SWR)	ERP Package Vendor (EPV) Customisation Level (CTL) Consultancy Services (CNTS) Implementation Approaches (IMPA)
Organisational Readiness (OGR)	Resource Mobilisation (RMO) Business Process Reengineering (BPR) End User Training (EUT)
Information System Readiness (ISR)	Data Migration (DMG) System Testing (STG) System Upgradation (STU)

II. Dependent Variables

Here, the study is required to analyse the impact of the CSFs in the process adopted by the organisation. Therefore, to understand the effect of the selected independent variable, the study attempts to analyse the changes in ERP implementation project performance. The performance can be figured out by identifying the difference in the time taken for ERP implementation, the cost involved in the ERP implementation and finally the quality of the project. The project's quality can be measured by analysing the changes that have occurred in the organization's capability and financial performance, as shown in Table 1.2.

Project performance (PP)

1. Project Cost (PC)
2. Project Time (PT)
3. Project Quality (PQ)
   - Organisational Capability (OGCB)
   - Financial Performance (FNP)

Table:1.2

Dependent Variables: Project Quality

Organisational Capability (OGCB)	Inbound Logistics (INLO) Outbound Logistics (OTLO) Operational Excellence (OPXL) Decision Making (DNMK) Strategic Impact (STIM)
Financial Performance (FNP)	Return on Asset (ROA) Return on Sales (ROS) Selling General and Administrative Expenses (SG&A) Cost of Goods Sold (CGS) Asset Turnover (ATR) Debtors Turnover (DTR) Inventory Turnover (ITR) Fixed Asset Turnover (FAT)

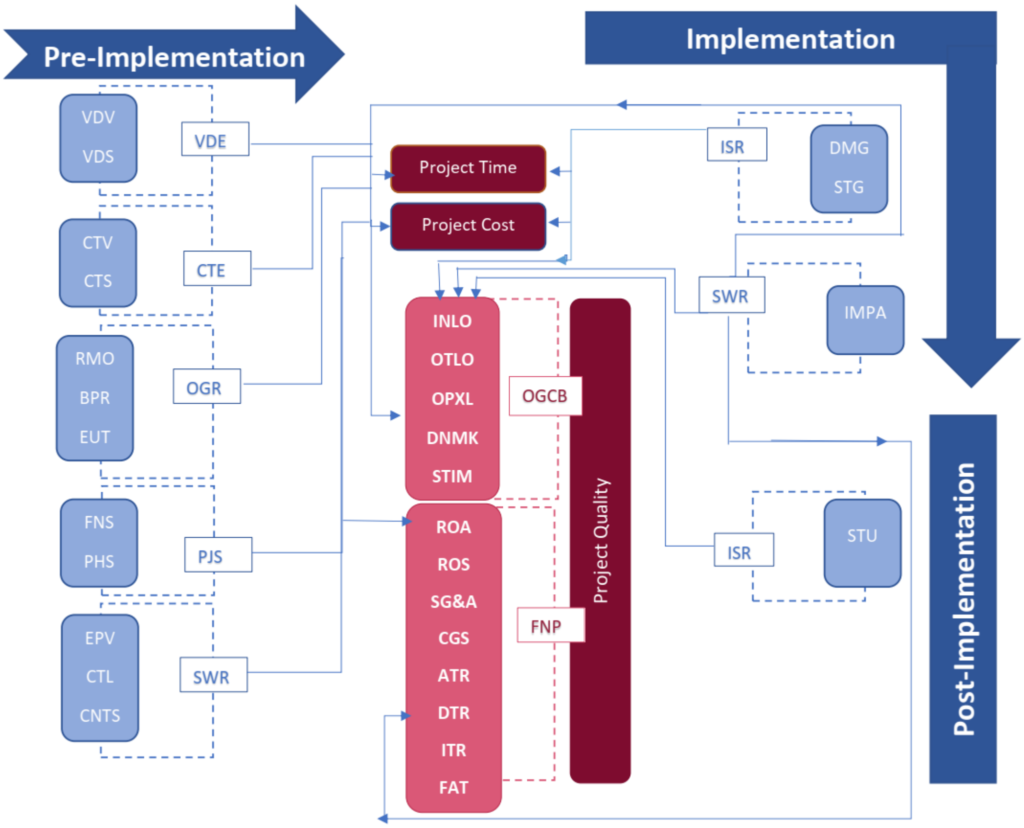
Source: Literature Reviews

1.7. Conceptual Model

The conceptual model provides a structure for identifying the impact of one variable over the other. The Figure 1.1 shows the conceptual model of the present study which reflects the interconnections between constructs and variables.

Figure 1.1

Conceptual Model of the Study



1.8 Operational Definitions

Here, the study explains the variables and concepts pertaining to the present research

I. Critical Success Factors (CSFs)

CSFs are the elements that are imperative to the success of the organisation's mission in the effective and efficient execution of the ERP implementation project.

Only the efficiency in accomplishing these CFs will lead to the ERP implementation Project success

a. Project Scope (PJS)

The scope of an ERP project refers to the extent of the project. It is defining the high-level initiatives project and functional areas purely based on the project goal.

- **Functional Scope (FNS)**

The functional scope of a project refers to the activities or services dealt with the implementation of the project under control.

- **Physical Scope (PHS)**

The Physical Scope of an ERP deployment specifies whether the project will span one or numerous sites within a single geographic region, or multiple sites spread over multiple national or worldwide regions. This is connected to the number of ERP users, and it has an impact on the ERP implementation's complexity, cost, and duration.

b. Vendor Evaluation (VDE)

VDE is a method of evaluating and approving potential vendors and suppliers to see if they will be capable of meeting the organization's requirements and obligations, once the contract is executed to reach the ultimate goal of profit maximisation

- **Vendor Viability (VDV)**

The capacity of a vendor to survive and flourish in the marketplace is referred to as viability. It is ensured by analysing the previous experience and success project of a vendor

- **Vendor Scalability (VDS)**

The organisation is dealing with the changing technology and business market environment. The scalability is the ability of the vendor to make the system to meet the changing market demand to adopt the developments in technology there by to c opportunity which ultimately facilitate the organisation in creating competitive advantages. It's vital to look at how effectively each ERP system will develop and expand during the vendor selection process.

c. Consultant Evaluation (CTE)

It is the process of assessing the services or activities of the consultants to check the potential of the consultant to identify the organisational requirements through business analysis, to assist in customisation and configuration, data migration, end user training etc. in the implementation of the ERP system thereby achieving organisational goals.

- **Consultant Viability (CTV)**

It is the capability of the consultant to sustain and grow in the competitive marketplace. It is possible to identify the viability of the consultant from their previous experiences and successful projects.

- **Consultant Scalability (CTS)**

The ability of the consultant to provide adequate service by responding to changing demands and business growth and to adopt and implement technological changes is referred to as scalability.

d. Organisational Readiness (OGR)

Organisational Readiness is the process of preparing business process, people and other resources to undergo a major change or to implement a new project in the organisation. It facilitates coordination and synchronisation, to make the new project productive.

- **Resource Mobilisation (RMO)**

The word "resource mobilisation" refers to any operations carried out by an organisation to gather new and enhanced financial, human, and material resources, along with rearrange or reconstruct existing resources, which is essential to undertake the upcoming projects efficiently and effectively.

- **Business Process Reengineering (BPR)**

Business process re-engineering, often known as BPR, is the fundamental redesign of business processes with the goal of identifying and root out obstructive inefficiency for making the business operations ready for accepting the implementing ERP system for achieving radical improvements in crucial areas such as output, cost, service, quality, and speed. Successful BPR and ERP implementation drastically reduces business costs and process redundancies.

- **End User Training (EUT)**

End-User Training is the process of ensuring that the users of the ERP system understand the new system, their effective utilisation and ultimately the company's requirements. It is the process of ensuring that the ERP software's ultimate users are well-versed in it and can utilise the system's capabilities without confusions and conflicts.

e. Software Readiness (SWR)

SWR is the method of acquiring the best ERP package and making the ERP system to cope with the requirements of the client and making use of the supporting systems for their effective implementation in the optimum way.

- **ERP Package Vendor (EPV)**

ERP suppliers are developers and producers of business software who design, sell, and deploy enterprise resource planning systems. Updates and new releases are also the responsibility of vendors to stay up with developments in the industry of their clients. Oracle, Infor, SAP, and Microsoft Dynamics are just a few examples.

- **Customisation Level (CTL)**

Customizing an ERP system entails making changes in the system to ensure that it serves the specific company´s needs. It includes modifying or improving current features, constantly updating the required features and choices that were not initially offered, modifying the application to support third-party functions, and introducing task management procedures.

- **Consultant Services (CNTS)**

ERP consultants are professionals at transferring the prevailing system, often fragmented corporate management systems to the new system. It's a collection of all the services and operations required to help the businesses to install enterprise software system. It is the sum of all the services and actions required to assist businesses in implementing and maintaining the enterprise software successfully for an indefinite period

- **Implementation Approaches (IMPA)**

IMPA is the process selected by the organisation to implement the developed ERP system to the business environment through different methods. There are various approaches used by the vendor, consultant and the enterprises for activating the ERP system in the business environment. Big bang approach, phased approach, parallel approach etc. are among them.

f. Information System Readiness (ISR)

ISR is the procedure through which the existing Information system required to change by converting the data of existing legacy system to the new ERP system and ensuring the practicality of the new system to make the system working as expected by the client at present and in future and finally to make the system free from the threats of errors, program crashing and security issues.

- **Data Migration (DMG)**

The process of transferring files from one device to another, from one geographical location to another, from one format to another, or from one software system to another is known as data migration. This is usually the outcome of introducing a new data system or a new location.

- **System Testing (STG)**

STG is the process of Quality Assurance (QA) which ensures the Enterprise system is executed properly and functional prior to going live or its rollout.

- **System Up gradation (STU)**

STU signifies the software's newer version with new features than the prior version, making corrections or changes or the existing features, and there by upgrading the system.

II. Project Performance (PP)

Project performance is the outcome of the execution of a project. It is the report of the measurement of the project's success in terms of its duration taken for the completion of the project, the cost involved in the accomplishment of the project and finally the measurement of the quality of the project**.**

1. Project Time (PT)

PT is the time frame of completing or accomplishing the planned project through its efficient and effective implementation to make use of the system for business operations.

2. Project Cost (PC)

PJC is the total cost involved in the planning and implementation of the ERP system in the organisation which includes package cost, Consultant cost, Customisation cost, data migration cost, system testing cost, training cost etc.

3. Project Quality (PQ)

Project Quality is the measurement of the accomplishment of the customer's requirement through the assessment of the benefits earned after the complete execution of the project. It is the measurement of the organisation's outcome after the implementation of the project in terms of its capability variance and variations in its financial performance.

a. Organisational Capability (OGCB)

The potential of an organisation to carry out its strategic operations using both tangible and intangible organizational resources to get work done, to carry out its business plan and finally to satisfy and retain its customers and thereby improves business and gives companies a competitive edge is termed as Organisational capability.

- **Inbound Logistics (INLO)**

A subset of company logistics known as inbound logistics describes the procedures involved with moving materials and information from the point of origin to the factory. It Involves various processes like sourcing, ordering, transportation, receiving, warehousing, managing, distributing, tracking and reverse logistics management.

- **Outbound Logistics (OTLO)**

The term "outbound logistics", a subset of business logistics refers to the meticulous preparations or logistics action made for the transportation of finished items or products from a warehouse or distribution hub to their final locations. It coordinates the supply chain process, from the moment a consumer places an order for a product until it is delivered to them or to a retailer

- **Operational Excellence (OPXL)**

The ability of an organization to continuously develop its systems and processes across the whole value chain in order to boost productivity and quality while lowering costs is referred to as operational excellence.

- **Decision Making Capability (DNMK)**

Decision making capability is the potentiality of the organisation in acquiring information and applying it for making significant corporate decisions so as to enhance overall organisational performance and ensuring a competitive edge.

- **Strategic Impact (STIM)**

Utilizing diversity and inclusiveness to better understand obstacles and discover new possibilities for innovative solutions.

b. Financial Performance (FNP)

A comprehensive review of a company's entire status in factors such as assets, liabilities, equity, expenses, revenue, and overall profitability is known as financial performance. It is calculated using a variety of business-related algorithms that enable users to calculate precise details about the potential effectiveness of the company

- **Return on Asset (ROA)**

Return on assets (ROA) is a metric that compares a company's profitability to its total assets. This ratio compares a company's profit (net income) to the capital it has invested in assets to determine how well it is functioning.

ROA = Net Income/Average Asset

- **Return on Sale (ROS)**

Return on sales is a financial ratio that compares how much profit a company makes on a sale to how much it spends on expenses or operational costs over the same time period.

ROS = Operating Profit/Net Sales

- **Selling, General and Administrative expense (SG&A)**

All everyday operating expenses of running a firm that are not included in the manufacturing of goods or delivery of services or non-productive expenses are referred to as SG&A

- **Cost of Goods Sold (COGS)**

The accumulated total of all costs needed to manufacture a product or service that has been sold is known as the cost of goods sold.

COGS = Beginning Inventory + Purchases – Closing Inventory

- **Asset Turnover Ratio (ATR)**

The asset turnover ratio measures the efficiency ratio that compares net sales to average total assets to determine a company's capacity to produce sales from its assets.

ATR = Net Sales/Average Total Assets

- **Debtors Turnover Ratio (DTR)**

DTR measures the activity ratio that identifies the relationship between the net credit sales in an accounting period and the average account receivables of the same accounting year. It is the activity ratio involved in the measurement of finding out the efficiency in collecting the receivables of an organisation.

DTR= Net Credit Sales/Average Trade Debtors

- **Inventory Turnover Ratio (ITR)**

ITR is an efficiency ratio that compares the cost of goods sold to average inventory to determine how effectively inventory is managed.

ITR = COGS/ Average Inventory

- **Fixed Asset Turnover Ratio (FAT)**

The fixed asset turnover ratio is an efficiency ratio that compares net sales to fixed assets to determine a company's return on investment in property, plant, and equipment.

FAT = Net Sales/ Average Fixed Asset

1.9 Research Period

The research period commenced in 2016 with literature reviews and expert interviews. In 2019, after finalising the variables, the survey questionnaire was finalised with two sections, one for the IT manager/ERP Head and the other for the

General managers. The study selected the listed large, medium, and small manufacturing companies in India's top three industrial states, namely Tamil Nadu, Gujarat, and Maharashtra. After the pre-test the survey for the pilot study was administered from June 2019 to October 2019. The main survey for the study had been carried out from January 2020 till February 2022 and the survey was conducted among the General Manager, Head of IT Department or/& ERP Head of the listed large and medium manufacturing enterprises in the top three industrial states of India. During the months of April and May 2021, the researcher also collected financial data for secondary analysis in addition to the primary data. In 2022, the researcher has completed the analysis and final report writing.

1.10 Research Methodology

Based on the field of study and type of investigation, the methodology followed in a comprehensive and in-depth study of the research problem is described in this section.

1.10.1 Research Design

The study made a serious attempt to describe, to collect data, to analyse, to interpret and to present the process of ERP implementation and its impact on the organisation’s capability and performance in an understandable manner. Hence, the study adopted a descriptive research design, as it conducts a detailed investigation on various aspects of the identified problem, to identify the facts regarding the problems and examining the facts and dimensions of the identified problem.

The theories of ERP implementation and its impact were collected and classified from various literatures. The study tested these theories empirically to know the real impact of in the manufacturing organisations to meet the research objectives. The study analysed the organisational capability and financial performance to predict the outcome of ERP systems implementation.

1.10.2 Sources of Data

Both primary and secondary data have been used for the research

A. Primary Data Collection Tools

The primary data were collected from the General Manager, Head of IT Department and/or the ERP Head through questionnaires. Two sets of Questionnaires were used for each organisation. One is to get data regarding ERP software implementation in the selected manufacturing units and another for receiving data on the impact of ERP. The primary data were collected from the selected manufacturing enterprises in Maharashtra, Tamil Nadu and Gujarat, which are the top three industrial states in India.

B. Secondary Data

Secondary data were compiled from the sources like:

- Central and state government reports
- Prowess Database
- Annual Statements of enterprises selected for the study
- EU KLEMS Database
- RBI Report
- News Paper Reports: The Economic Times, Business Standard, Money Control, Business Today, Outlook Business and The Financial Express
- BSE Annonuncements
- MIS Journals and related journals
- Websites of stock brokers
- Magazines
- Books

1.10.3 Target Population

The target population for the study is the ERP implemented manufacturing enterprises in Indian Industry. In most developed countries, excellent database systems like Compustat Database, are available with detailed data regarding the ERP implemented Enterprises. In India, the list of ERP implemented companies in the manufacturing sector is not available. As the study is required to analyse the financial performance of the ERP implemented manufacturing enterprises, it is very essential to gather the financial reports of the selected organisations. Prowess database is one of the popular databases in India, which have the financial reports of listed companies in the country. So, the study selected those manufacturing companies as the target population, which are listed on stock exchange and their data are available in the Prowess database.

From the report of the Government of India, Ministry of Corporate affairs total number of companies registered as on 31st January 2018 stood at 17,29,363 of which only 11,51,153 companies are active as on March 2019. From them 10,63,802 are listed in BSE and NSE. As per the study of Trivedi et al., (2011), the Development Research Group (DRG) of RBI, in terms of the manufacturing sectors in various states, Maharashtra, Tamil Nadu, and Gujarat routinely ranks as the first three topmost states in terms of both output and employment generation in the organised manufacturing sector. As per the RBI GDP state wise report of 2018, the top three industrial states were Maharashtra, Tamil Nadu and Gujarat. As the study, considered these aspects and selected these three states for collecting the required data for knowing the impact of ERP implementation in the manufacturing sector. From, the report of the Government of India, Ministry of Corporate affairs, it was found that there are 2,26,993 listed manufacturing companies in Maharashtra, 75, 143 in Tamil Nadu and 61,593 in Gujarat.

The present study requires data from the General Managers on the impact of ERP and from the ERP Heads, the various CSFs in the process of ERP implementation. Thus, two sets of data together make one sample response. Hence, the target population is the General Managers and the ERP Heads of the listed large and medium scale manufacturing enterprises in Maharashtra, Tamil Nadu and Gujarat states.

1.10.4 Sampling Technique

The study utilised the purposive sampling technique for selecting the sample. According to Bernard (2006) It is a non-probability sampling used to obtain data from a specific target population that is hard to find and elements in the population do not have to be selected as subject in the sample. Bernard (2006) also explained that, in purposive sampling technique the researcher determines what information is required and identifies the respondents who can and are willing to provide the required data. This is because the respondents need to be aware of the criteria set by the researcher and only, they can provide the required data based on their knowledge and expertise regarding the underlying research problem.

The study required to collect the samples from the ERP implemented large and medium manufacturing enterprises in India. The population consists of the General Managers and the ERP/IT heads of the large and medium manufacturing enterprises and it is an unknown population. Hence, first, the study purposefully select the geographical location having large number of enterprises and then to identify the large and medium manufacturing enterprises which have implemented ERP. Then to identify those who can provide the desired panel data (financial statement of ten years prior to ERP implementation and ten years after the ERP implementation). Thus, in order to select a sample that satisfies all these conditions, Purposive Sampling Technique is found to be the most suitable one.

1.10.5 Sample Size Determination

The sample size is determined after considering the population. The target population for the study is the constituted by the general managers and ERP/IT heads of the firms, which are more homogeneous. Kock and Hadaya (2018) suggested the Inverse Square Root Method for determining the sample size when the population is more homogeneous. Thus, the study decided to select the Inverse Square Root Method for determining the sample size.

- **The Inverse Square Root Method (ISRM)** was proposed by Kock and Hadaya (2018). ISRM does not rely on Monte Carlo simulations or the minimum R-squared methods or the elements that comprise the 10 times rule. It takes into account the probability that the ratio of a path coefficient and its standard error will be greater than a test statistic's critical value for a given significant level.

The minimum sample size is given by the following equations, assuming a common power level of 80% and significance levels of 1%, 5%, and 10%, respectively,

Significance Level = 1% : $n_{\min} > \left(\frac{3.168}{|Pmin|}\right)^2$

Significance Level = 5% : $n_{\min} > \left(\frac{2.486}{|Pmin|}\right)^2$

Significance Level = 10% : $n_{\min} > \left(\frac{2.123}{|Pmin|}\right)^2$

$n_{\min}$ is the minimum sample size

*P*min is the path coefficient in the PLS path model with minimum magnitude

Even after the pilot study, the researchers may not have enough information regarding the expected effect size. Hence, it is better to rely on the ranges of effect size than on a specific value. Since the ISRM is rather a conservative, method it is reasonable to select the reference from the upper range of the effect range. The table 1.3 shows the required minimum sample size for a different range of *P*min at different significant levels.

Table 1.3

Sample Size threshold

***P*min**	**Significance Level**		
	1%	**5%**	**10%**
0.05 - 0.10	1004	619	451
0.11 – 0.20	251	155	113
0.21 – 0.30	112	69	51
0.31 – 0.40	63	39	29
0.41 – 0.50	41	25	19s

Source: Kock, N., & Hadaya, P. (2018). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Information Systems Journal*, 227–261.

Here, the study assumes a significance level of 5% (which is commonly used by the social science research) and a minimum path coefficient 0.2. Hence, the minimum sample size can be determined by the equation

$$\text{Significance Level} = 5\% : n_{\min} > \left(\frac{2.486}{|Pmin|}\right)^2$$

$$n_{\min} > \left(\frac{2.486}{0.2}\right)^2 = 154.505$$

Thus, by rounding the result into the next integer, the minimum sample size is 155 and the study fixed the minimum sample as 160 manufacturing enterprises listed on the stock exchanges in India.

1.10.6 Period Considered for Data

It has been found that, many studies have taken different periods to express the real impact of ERP implementation. Hendricks et al., (2007) proposed a period of three years post ERP implementation as the ideal period to identify the real impact of ERP. Vuksic and Spremic (2005) proposed a five-year post implementation period to identify the changes happening in the business operation and results. Ash and Burn (2003) identified a retirement period of ERP, where the existing ERP shows a declining impact after 5 or 10 years of implementation.

Thus, the study considered data of 20 years, which includes 10 years prior to the ERP implementation and 10 years after the implementation. The study selected only those listed manufacturing companies which have a business experience of 10 years prior to ERP implementation and 10 years after the implementation.

1.10.7 Tools for Data Collection

Primary Data: The study used survey method for collecting data from the respondents. A survey is a method of gathering information from respondents in order to achieve a predetermined research goal (Bajpai, 2018). Here, the information was collected from the respondents through structured questionnaire. The questionnaire had been loaded to the "Jotform" and it had been forwarded to the respondents through the mail and the respondent returns the filled questionnaire by submitting the

"Jotform". Jotform is a San Francisco–based company that specialises in the creation of online forms.

The study used **Mail Survey** to collect data through a structured questionnaire. Mail survey can provide accurate result as the respondents will get enough time to think and also they can take necessary support from other persons; and it can cover an extensive geographical area with relatively lesser time and cost (Bajpai, 2018; Gillham, 2000).

To get a more precise response the questionnaire was prepared in two sections, according to the nature of the respondents. The study needed data regarding the ERP software that was implemented in the company, like ERP vendor, customisation, implementation approaches etc., Hence, it is necessary that the respondent should be a specialist in ERP software used in their organisation, Therefore, the first part of the questionnaire was mailed to the ERP Heads and/or to the IT Heads of the organisations. The second part of the questionnaire was drafted to collect data on the impact of ERP implementation on the Organisational Capability. This was distributed to General Managers of the enterprises.

Secondary Data: To know the real impact of the selected CSFs on the organisation, the study considered the impact on the financial performance of the organisation. Only manufacturing units were selected for the study to analyse the exact quantitative benefits. All the companies selected for the study are listed NSE and/or BSE. For analysing the financial performance, the data of the selected 160 companies were taken from Prowess database maintained by Centre for Monitoring Indian Economy Private Limited (CMIE). To analyse the real impact of ERP, the study required the data for 10 years prior to ERP implementation and 10 years after ERP implementation, but the study received only 151 samples with the financial data of 10 years pre and post ERP implementation period. The study tried to get the financial data of at least 5 years prior to and 5 years post ERP implementation of the 9 samples. But the researcher received incomplete date file. Hence, 9 samples were removed and the study finalised 151 samples for secondary data analysis.

1.10.8 Questionnaire Design

i. Pre construction phase: This phase specified what type of information is required by considering the research objective, identified an overview of the respondents' characteristics and analysed various survey techniques and decided to select questionnaire for data collection

ii. Construction phase: The study used open-ended questions, closed ended questions, dichotomous questions and multiple-choice questions. The researcher tried to use simple and easy to understand words to avoid vague or ambiguous questions, and to avoid double-barrelled questions, leading and loaded questions and also overstated words. The researcher also considered the respondents' ability to answer the questions.

iii. Post-Construction phase: This is the final stage of questionnaire drafting.

1.10.9 Pre-testing and Pilot Study

Pretesting of the questionnaire is very significant before conducting the pilot study to identify and eliminate the potential problems in the constructed questionnaire.

According to Reynolds and Diamantopoulos (1998) the pre-test is used to ensure that the questionnaire is appropriate for the survey in terms of structure and language, as well as to allow the researcher to ensure that the information required from the target population can actually be collected via the research instrument i.e., the questionnaire. Four pre-testing methods were suggested by Blair and Presser (1992) to make the pre-test an effective one and it includes expert panels, the conventional pre-test, behavioural interaction coding and cognitive interviews.

The questionnaire was pretested with the doctoral students, statisticians and subject experts for content validity, comprehensiveness and readability. The researcher conducted a survey on three samples with the drafted questionnaire for the pre-test and observed the individual behaviour while filling the questionnaire and tried to find out the deviations from the expected behaviour of the respondents. By conducting an interview with the sample respondents, the study also tried to identify any common issues, if any, in answering the questions.

The pre-test and the subsequent pilot test were carried out among the companies in the manufacturing sectors in Kerala and Tamil Nadu respectively. (Arain et al., 2010) explained pilot study as a scaled-down version of the main study and therefore resembles the main study in many respects. The pilot study was done among 35 respondents to check, whether the techniques, methods and questionnaire adopted for the study are feasible or not. i.e., to test whether the main study's components can all work together. In order to conduct a survey, the researcher incorporated all the information obtained from the pre-test and pilot test into the study design.

1.10.10. Data Analysis

In the words of Haring (2008) data analysis is an important process that should be well described, documented, and explained. As the research adopts descriptive research design, it started with scale development to gather data through questionnaires regarding the CSFs in the process of ERP implementation and the changes in organisational capability. Statements were also developed to identify the demographic profile of the sample. The demographic data describes the type of industry, size of company, geographical location, cost and time taken for ERP implementation and designation of respondents. Frequencies, Means and Percentages were used for summarising the demographic data.

Smart PLS 3 software, IBM SPSS statistics and Ms Excel were employed for data analysis to test the proposed hypotheses of the study. Before testing the hypotheses, the construct validation was done using Factor analysis. Smart PLS 3 software was used for the validation and reliability checking of data. The summarised data is then scrutinised for normality using Kolmogrov- Smirnov, Shapiro-Wilk tests and Skewness and Kurtosis. The test result indicates that the data lacks normality. Hence, the study employed Nonparametric test.

The non-parametric tests, Kruskal Wallis test and Mann whitening U test are used to check the difference between variables. Path coefficient and regression scores were used to identify the real strength or degree of impact of the identified CSFs on the organisational capability. Smart PLS and other PLS-SEM software applications provide results for all types of variables, regardless of whether they have metric, quasi-metric, ordinal, or categorical scales (e.g., binary coded) (Ringle et al., 2005). However, in its most basic form, PLS-SEM requires metric or quasi-metric data. Other scale levels alter the interpretation of the results or violate the method's fundamental requirements. So, Smart PLS was employed to identify the same for non-categorical data and multivariate regression for categorical data. The strength or degree of impact of CSFs on financial performance was identified through regression analysis using MS Excel.

The test used for various purposes in the study is detailed below

A. Normality Test

Normality test is sometimes called as Gaussian distribution or bell-shaped curve. It is a symmetrical continuous probability distribution and it is very significant before initiating a statistical analysis. Hence, it is very important to test the normality of data to prove that the basic assumption has been satisfied for conducting parametric test. Kolmogorov-Smirnov (K-S) test was used to assess the normality and it was identified that none of the variables fall within the range of the normal distribution and also the values of skewness and kurtosis were not within the acceptable limit ±2 (George & Mallery, 2010) and ±10 (Collier, 2020) respectively. Hair et al., (2006) explained the acceptable limit of skewness and kurtosis between ±2.58 and ± 1.96 respectively. Values that fall outside these ranges are suspicious, hence questionable. Since the entire dependent variables to analyse the impact on organisational capability violate the normality assumption, it is acceptable to conduct non-parametric tests on the primary data.

B. Fitness of the Instrument

The study used two structured questionnaires for collecting the primary data from the respondents. In order to ensure its fitness, it is required to measure, whether the research instrument is capable of achieving the research objectives, answering the research questions and to prove or disprove the hypothesis testing. Hence, the research instrument should be validated and must prove the reliability. The following techniques and tests were used for this purpose.

I. Content Validity

Content validity is the subjective evaluation of the scale, to check whether the scale should have possessed the ability of measuring what it is supposed to measure. It is to check whether the items in the questionnaire are a good sample of that larger domain. Content Validity is concerned with the adequacy of sampling of a measure's content (Loiselle et al., 2011), The content validity of this study is determined by the subject experts after looking at the different items to decide if that item represents the construct under study.

II. Construct Validity

In the words of Loiselle et al., (2011) Construct validation involves an examination of relationships based on theoretical prediction. The construct validation is the application of a statistical procedure known as factor analysis

Factor Analysis

The factor analysis could be Exploratory Factor Analysis (EFA) or Confirmatory factor analysis (CFA) (Loiselle et al., 2011)

❖ **Exploratory Factor Analysis**

EFA is one of the data reduction techniques and its objective is to explain the relationship of many observed variables by a relatively small number of factors (Salkind, 2010). It is a multivariate technique that uses the three sets of parameters 1. Factor loading associated with unobserved variable. 2. Residual variances called unique variations and 3. Factor correlation to model the covariance structure of the observed variable (Salkind, 2010). It does not assume any model based on the theory (Salkind, 2010; Hair et al., 2016)

Since, Exploratory analysis needs to conduct, when there is no or only little prior knowledge on how the variables are related so as to search for the patterns in the data, it is not relevant to use EFA in the study as there is enough established knowledge on the relationship of the variable's selected for the study.

❖ **Confirmatory factor analysis**

CFA is designed to confirm a theoretically established factor model (Salkind, 2010). It is used when there is need to test the hypotheses of existing theories and concept (Hair et al., 2016). There are two approaches: the repeated indicators approach and two stage approach for measuring the constructs. Wetzels et al., (2009) suggested the two-stage approach as an alternative to the repeated indicators approach.

Here, the study used disjoint two-stage approach rather than embedded two-stage approach. In the embedded two stage approach models the entire Higher Order Constructs (HOC) are present in its first stage and the disjoint approach only the Lower Order Constructs (LOC) will be there in its first stage and that make up the Higher Order Constructs in the second stage. (Ringle et., 2012; Agarwal and Karahanna, 2000; Becker et al., 2012)

Cheah et al., (2019) in their study proved that both approaches lead to the same result, and as most of the literatures preferred disjoint two stage approach the present study selected the same rather than embedded two stage approach for validating the constructs.

In the disjoint two-stage approach only, the Lower Order Construct is considered without the Higher Order Constructs. The scores obtained from the Lower Order Construct can be used to measure Higher Order Constructs. The higher order model should be evaluated with the measurement model of the Lower order Components. So, the study validating and reporting the Reliability and validity of both the Lower Order Construct and Higher Order Constructs using the disjoint two-stage approach. For validating the reflective factors, Factor loadings, Indicator Multicollinearity (VIF), Indicator reliability, internal consistency/composite reliability, convergent validity (AVE) and discriminant validity are examined, whereas, the formative factors are validated by significance and relevance of outer weights/loadings, Collinearity among indicators and lower VIF values (Nomological net/external validity). The study is using smart PLS 3 for the measurement model and the structural model

- **Structural Equation Modelling (SEM) -Smart PLS 3**

Through the 1980s, the use of first-generation statistical methods such as factor analysis and regression analysis dominated the research landscapes (Hair et al., 2017). However, second generation methods have grown rapidly since the early 1990s and now account for nearly half of all statistical tools used in empirical research in some disciplines.

Smart PLS (Partial Least Squares) is one of the leading statistical software used to estimate the variance-based SEM (Structural Equation Modelling) using partial least squares normally known as PLS SEM. It also has a graphical user interface and it normally used if the model is complex. A model that contains many constructs i.e., latent variables, indicators and multiple relationships. The assumption of data normality is not required for the accuracy of test results in Smart PLS and it is very robust pertinent to normality issues

In this study the PLS SEM is used for assessing the relationship between the Construct, Vendor Evaluation, Consultant Evaluation, Organisational Readiness, Information System Readiness, Customisation Level, Consultancy Services, Implementation Approaches, ERP Package Vendor, Functional Scope and Physical Scope with the Inbound Logistics, Outbound Logistics, Decision Making, Strategic Impact and Operational Excellence the manifest indicators i.e., the observable measures.

PLS SEM actually divided into two different models, one is the measurement model and the other is the structural model. The reliability and validity can be assessed through the measurement model and the structural model in smart PLS determines the impact of latent variable on the Higher Order Constructs

i. Measurement Model Assessment

The Measurement model assessment is actually evaluating the factors in the constructed model so as to identify, whether the measures are good enough or not. Here, the study used the reflective-formative model in validating the constructs. As the study is using the disjoint two stage approach, in the first stage it is validating the Lower Order Construct and then in the next stage the Higher Order Construct using the Latent Variable Score (LVS) generated from in the first stage of Lower Order Construct validation.

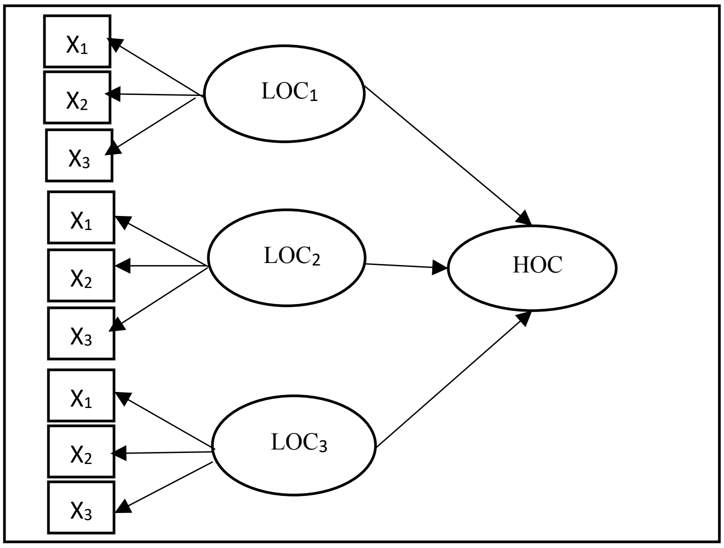
Reflective and Formative Indicators

The constructs can be classified into two based on the interchangeability of their indicators as reflective and formative factor. That is, whether the observed measures are interchangeable or not determines whether the indicators are reflective or formative. When the measurements may be used interchangeably, they are referred to as reflective measures; otherwise, they are referred to as formative indicators. Interchangeable means, the concept is expressed in the various indicators, and non-interchangeability is a condition where each indicator provides the construct a particular meaning. As per MacKenzie et al., (2011), it is very significant to note that the relationship between an indicator and the corresponding construct is referred as the terms formative and reflective. Constructs are not intrinsically formative or reflective in nature, but the majority of them can be modelled using either formative or reflective indicators depending on the researcher's theoretical assumptions for how they should connect based on the conceptual description of the construct (MacKenzie et al., 2011).

The conceptualization of the construct might not alter even if one or more visible indicator were eliminated; instead, the latent construct, which is the reflective construct, would remain unchanged. If the indicator changes in the formative model, the study's construct, or the latent construct, which depends on the measures, will be impacted. The reflective method for measurement is largely responsible for the scale development in social science research. Models for formative assessment are only advised where there is a definite theoretical requirement (Singer, 2019). The figure 1.2 demonstrates the reflective formative Measurement model

Figure 1.2

Reflective-Formative Factor Model



Note: The three LOCs (LOC_1, LOC_2 and LOC_3) and its relationship with its indicators represents the Reflective Model and the three LOCs (LOC_1, LOC and LOC_3) and its relationship with its HOC represents the Formative Model

Source: (Hair et al., 2016; Hair et al., 2011; Fornell & Larcker, 1981; Teo et al., 2008; Coltman et al., 2008; Sarstedt et al., 2019)

1. Validating Lower Order Constructs

Lower Order Constructs are the independent variables used to predict the dependent variable. In Smart PLS, the first stage is to validate the Lower Order Construct. Later, the generated Latent Variable Scores (LVS) after validating the Lower Order Construct should be used as an indicator to validate the Higher Order Constructs.

- **Factor Loading or Outer Loading**

The extent to which each item correlates in the matrix of correlation as per the specified principal component is meant to refer as factor loading and the absolute value of factor loading can range from -0.1 to +0.1(Pett et al., 2003). The highest absolute value implying a higher correlation of the variables with the concerned factor. But the study selected the minimum value 0.50 as most of the studies including the studies of Chen and Tsai (2007); Hulland (1999); Truong and Mccoll (2011) adopted the same value to check the factor loadings. So, the items under the study should have the factor loadings more than 0.50 otherwise, the item should be considered for removal.

- **Indicator Multicollinearity (VIF)**

The extent to which the other variables in the analysis can explain a variable (Hair et al., 2013). As multicollinearity increases, the assessment of the variate becomes more difficult as it is more difficult to determine the influence of any single variable due to their interrelationships (Hair et al., 2013). The term multicollinearity is representing a situation in which two or more input variables have an exact or nearly exact linear relationship (Hocking and Pendleton, 1983). The exact linear relationship may happen due to lack of understanding of the concerned variables or may happen by mistake. The indicators multicollinearity can be identified with the statistic, Variance Inflation Index (VIF) (Fornell & Bookstein, 1982). The threshold value of multicollinearity has been discussed by Hair et al., (2016) and comes to a conclusion that there are no such issues with multicollinearity, if the VIF value is less than 5.0.

- **Reliability**

The degree where an experiment, test, or any measuring method generates a result that is very stable and consistent each time on repeated trials is referred to as reliability (Carmines and Zeller, 1979). Hence, repeatability is also very significant to confirm the reliability. Repeatability means the measurement yields same result under the same conditions, if repeated (Moser and Kalton, 1979). Cronbach's Alpha and Composite Reliability are the common methods used for conforming the reliability.

Hair et al., (2011) suggested the required threshold for establishing the construct reliability is above 0.70.

➢ **Construct Validity**

Construct validity is used to check whether the constructs are measuring what they are intended to measure or what they are required to measure. The validity of a construct while using PLS SEM statistically can be established only if the construct establishes both the Convergent and Discriminant validity

o **Convergent Validity**

The extent to which repeated attempts at measuring the same concept agrees is referred to as convergent validity (Bagozzi et al., 1991). The intention is that if two or maybe more measures with the same item should vary significantly if they are the valid measures of the concept. This can be interpreted through Average Variance Extracted (AVE). The establishment of convergent validity is possible when the required value of AVE is greater than or equal to 0.05 when items converged for measuring the underlying construct to prove the validity otherwise there may be convergent validity issues. So Convergent Validity is measuring whether the latent items convergent i.e., they come together or work together to measure the latent construct, and it can be established if AVE > 0.05

o **Discriminant Validity**

It is about differentiation in the construct. It is done to establish that the constructs use in the study is statistically different and each construct has got their own individual identity. It is the extent to which different concepts' measures differ and the assumption is that if two or more notions are distinct, valid measures of each should not have a high correlation (Bagozzi et al., 1991). Scores on the measure are not related to other measures that are theoretically different. There should be high correlation. There should be no or low correlation. The construct is said to have discriminant validity only if the square root of AVE (identified while checking the convergent validity) should be higher than the correlation between the constructs under study i.e., the correlation between the predictor variable and the dependent variable.

It can be established in three ways: Fornell -Larcker Criterion, cross loadings and Heterotrait-Monotrait Ratio (HTMT).

a. **Fornell -Larcker Criterion:** Whenever the square root of the ave for a construct is significantly larger than the correlation with all the other constructs, validity is achieved. (Fornell and Larcker, 1981)

b. **Cross Loadings:** Cross Loading is useful in determining whether the factor loading of all the items belonging to a specific construct loads heavily on its own parent construct rather than other constructs within the study (Wasko & Faraj, 2005)**.**

c. **Heterotrait-Monotrait Ratio (HTMT):** The prediction of the correlation between the constructs underpins HTMT. Different literatures are showing different threshold for determining discriminant validity under HTMT. Threshold of 0.85 or less recommended by Kline (2005) and Teo et al., (2008) suggested a threshold of 0.90 or less, which has been commonly used for validation

2. Validating Higher Order Construct

After reporting the Lower Order Construct, their reliability and validity, the next part of the study is the formation and assessment of Higher Order Constructs. The generated latent variable scores obtained after assessing the Lower Order Construct were served as indicators for the Higher Order Constructs and thus form the Higher Order Construct.

The Outer Weights and VIF should be required to establish the validity of Higher Order Constructs. The Outer Weights should be considered significant only if the p value is less than 0.05 and t statistic, greater than 1.96. It is also very significant to check whether the VIF value crossed the threshold value 5 suggested by Hair et al., (2016), it is said to be significant only if the calculated value is less than the threshold value 5. This establishes the non-multicollinearity in the model. The Higher Order Constructs of the present study are formative models and not reflective model. Hence, assumes a lesser correlation or no correlation among indicators and therefore collinearity statistic (VIF) should be examined properly.

The table 1.4 shows the criteria for assessing the validity of Reflective model and table 1.5 shows the Formative Model respectively.

Table 1.4

Rule of thumb: Reflective Measurement Model (LOC)

<table>
<tr><th colspan="2">Validity Indicators</th><th>Recommended threshold</th></tr>
<tr><td colspan="2">Factor/Outer Loading</td><td>>0.50</td></tr>
<tr><td colspan="2">Multicollinearity (VIF)</td><td><5.00</td></tr>
<tr><td colspan="2">Internal Consistency Reliability</td><td>Cronbach alpha>0.70</td></tr>
<tr><td colspan="2">Composite Reliability</td><td>>0.70</td></tr>
<tr><td rowspan="2">Construct Validity</td><td>Convergent Validity</td><td>Average Variance Extracted (AVE) ≥0.50</td></tr>
<tr><td>Discriminant Validity</td><td>o FL Criterion: the square root of the AVE > its correlation with all other constructs
o Strong Cross loadings
o HTMT Ratio: ≤0.90</td></tr>
</table>

Note: 1. If the outer weight is insignificant, the indicators need to remove only after considering the significance of factor loadings. 2. If the factor loading is less than 0.50 the item can be considered for removal only after considering the reliability and whether the removal leads to an increase in AVE above 0.50. Otherwise, the item need not be considered for deletion if it is important to the study.

Source: (Chen & Tsai, 2007; Coltman et al.,2008; Fornell & Larcker, 1981; Hair et al., 2011; Hair et al.,2016; Hulland, 1999; Sarstedt et al., 2019; Teo et al., 2008; Truong & Mccoll, 2011)

Table 1.5

Rule of thumb: Formative measurement Model (HOC)

Validity Indicators		Recommended threshold
Path Loadings	Outer weights	P<0.05
	T statistics	>1.96
	P value	<0.05
Multicollinearity (VIF)		<5

Source: (Hair et al., 2016; Sarstedt et al., 2019)

ii. Structural model

After validating the Lower Order Constructs and Higher Order Constructs the next step is running the Structural Model. It is used to assess the relationship and the effectiveness of one variable or a group of variables on other variable or a group of variables.

The structural model can be assessed only after assessing the measurement model. But in smart PLS the measurement model analysis and structural model analysis can do with the same order or in the same model.

C. Primary Data Analysis

After validating the measurement model, the study uses the SPSS and PLS SEM to analyse the primary data collected from the respondents. The study used nonparametric test to find the changes in the capability of the organisation due to the CSFs in the process of ERP implementation and its components and to find out the changes in the time taken for ERP implementation and the cost of ERP implementation.

D. Secondary Data Analysis

To ascertain the impact of ERP implementation on the financial performance of the organisation, the study requires secondary data analysis.

❖ Regression Analysis

The Multiple regression method is used for analysing and interpreting the impact of CSFs on firms' financial performance. The Regression analyses are required to carry out after checking, whether the data set satisfies the basic assumptions. It is mandatory to weed out the outliers in the data set and the study used descriptive statistics to point out the outlier. The significant correlation coefficients among the independent variables need to check to identify whether it is within the threshold 0.80 (Gujarati and Porter, 2009; Dougherty, 2016). Identification of Variance Inflation Factor (VIF) value, whether it is within the prescribed threshold is the common method to test the Multicollinearity between the predictor variable. Multicollinearity is a concern if the VIF value is greater than 4.0 or the tolerance is less than 0.2 (Hair et al., 2010) . (The VIF value less than 4 indicates no or moderate correlation, which is an acceptable correlation). The study used the Durbin-Watson (d) score (non-auto correlated if the p value is greater than 0.05 and d score is near to 2 i.e., between 1.5 and 2.5) and Breusch-Godfrey (BG) Test (if the p value is greater than 0.05, indicates that there is no auto correlation) for checking the serial correlation or autocorrelation in panel method. The study also used Breusch-Pagan test to check the heteroscedasticity (if the p value is greater than 0.05, indicates that there is homoscedasticity).

To control the size of the organisation, the study used Market Capitalisation, number of employees and total assets as controlling variables along with the debt equity ratio to control the leverage. **Control variables** should not be given too much meaning by researchers, and they should consider ignoring them entirely when interpreting the results of their analysis (Hünermund and Louw, 2020). It is preferable to avoid reporting marginal effects of controls in regression tables and instead focus solely on the variables of interest in empirical research paper results sections.

The study needs to determine whether ERP implementation makes any difference in the response variable from one time period to the second time period by using dummy variables. The time series analysis has been done after taking the years undertaken for the study as dummy variables using the binary code '0' and '1'. The years prior to ERP implementation has been coded as ‘0’ and for the post implementation years as ‘1’.

Constant or intercept is the average expected value for the response variable when all the predictor variables are equal to zero (Zach, 2019). But in some cases, the predictor variable may not become zero (here variables like implementation approaches, vendor etc..). Hence, the regression coefficient for the constant simply anchors whether the regression line is in the right place. In the Constant or intercept the p value is less than 0.05 the response variable changes are due to the changes in the predictive variable and not on a random chance

R^2 (*coefficient of determination)* is indicating the percentage or proportion of variance made by the independent variable on the dependent variable. It shows the degrees to which the data fit in the regression model. The strength of the linear relationship between predictor variable and response variable (Zach, 2019). (Range from o and 1) A value of 0 indicates that the response variable cannot be explained by the predictor variable at all. A value of 1 indicates that the response variable can be perfectly explained without error by the predictor variable. It is important to note that R-square is very small or near to zero or statistically significantly different from zero, indicating that your regression model has statistically significant explanatory power (Paetzold, 2016).

Adjusted R^2 is the result of model fit when unexpected things were adjusted.

Coefficient (correlation coefficient) measures the strength of linear relationships with predictor variables and the response variable. If 0 no linear relation and 1 indicates a perfect linear relation (Zach, 2019).

The **F-Test of overall significance** in regression is a test of whether or not your linear regression model provides a better fit for a data set than a model with no predictor variables (Zach, 2019). If the p-value is less than the significance level you’ve chosen (*common choices are 0.01, 0.05, and 0.10*), then you have sufficient evidence to conclude that your regression model fits the data better than the intercept-only model.

The **standard error** of the regression is the average distance that the observed values fall apart from the regression line.

1.11 Limitations of the Study

1. According to EU KLEMS 72 industrial classification, there are 23 industries belonging to manufacturing sector and the study carried out by using the data of only 19 industries. The sample size from each industry ranges from a minimum of 4 and a maximum of 48. This limits the generalisation as the study could not access data from some industries and also the small sample from some other selected industries in the manufacturing sector.

2. The study had confined to the manufacturing sector in India, but there are several other sectors like construction, wholesale and retail trade, hotels and restaurants, finance, insurance, telecommunication etc… which use ERP packages.

3. To get sufficient data the study focused on the industrially populated area in India. Hence, the study selected only the top three industrial states in India to represent the population.

4. Cloud ERP adoption has exploded in recent years, but the present study focused only on traditional or on-premise ERP.

5. While conducting piolet study, the present study failed to get enough primary data from small scale enterprises. Hence, for further analysis the study considered only large and medium manufacturing enterprises which implemented the ERP software system.

1.12 Chapterisation

The thesis is organised in the following manner.

Chapter One: The Process and Impact of Implementing Enterprise Resource Planning System in Manufacturing Enterprises in India

The first chapter provides an introduction to the research. It covers the significance of the study, statement of the problem, scope of the study, objectives, hypotheses, variables used, conceptual model of the study, research methodology adopted, limitations of the study and chapterisation.

Chapter Two: ERP: Review of Literatures

This part of the research presented a brief description about the previous literatures in the area of the present study. It focused on the literature on the process of ERP implementation, CSFs associated with ERP implementation, impact of ERP implementation and other studies on IS and IT

Chapter Three: ERP- An Overview

The chapter is trying to provide a basic knowledge about ERP, regarding the implementation approaches, ERP vendor, theoretical base, modules of ERP, ERP evolution, Information on geographical area of the study and other theoretical base

Chapter Four: ERP Implementation Process and the CSFs

The chapter is purely based on different theories and concepts propounded in different literatures. The objective of this chapter is to pin down different factors which are significant for a successful ERP implementation. These factors are in the process of ERP implementation and eventually the study tried to frame an ERP implementation process for successful implementation.

Chapter Five: CSFs: ERP Project Time and Cost

This chapter provides the profile of the respondents, the impact of CSFs on the time of ERP implementation and the impact of CSFs on the Cost of ERP implementation.

Chapter Six: ERP Implementation Impact: Organisational Capability

This chapter focuses on the impact of CSFs in the process of ERP implementation on the capability of the organisation and its components.

Chapter Seven: ERP Implementation Impact: Financial performance

This chapter focuses on the impact of CSFs in the process of ERP implementation on the financial performance measured by ROA, ROS, SG&A, CGS, ATR, DTR, ITR and FAT of the organisation.

Chapter Eight: Summary, Findings, Discussion and Conclusion

This chapter lists the summary of the entire research work, findings and finally the conclusions from the study.

Chapter Nine: Recommendations, Implications and Scope for further Research

The final chapter of the thesis gives recommendations based on research findings, Implication of the recommendation put forward by the study and the suggested areas for further research on the topic ERP.

1.13 Summary

This chapter of the thesis provides an overview of the study. Started from the introduction of the thesis, presented the significance and scope of the study, the research problem and research questions and the objectives of the study. The formulated objective was to identify the ERP implementation process and its impact. For achieving the objective, the study listed the relevant variables, presented the conceptual model of the study and gave operational definitions. Then, the study explained the period of research and the methodology adopted by the researcher. In the methodology part contained the research design, sources of data, target population, sampling technique, sample size determination using inverse square root method, research period, data collection tools, details regarding the designing of questionnaire, pre-testing and pilot study, tools and techniques used for data analysis. The final part of the introduction chapter presented the limitations of the study and chapterisation.

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Chapter Two

ERP: REVIEW OF LITERATURES

2.1 Introduction

The literature reviews in this chapter portray the synthesis of research works and other studies on the ERP adoption, implementation and its impact and other related topics on ERP. In addition to that, the chapter also considered the studies on Information System (IS) /Information Technology (IT) implementation to get a concrete picture of the usage of IT in business. The research works and studies on the above-mentioned area received from various journals, thesis, books, conference proceedings and publications in the websites.

The literature reviews upgrade the knowledge on ERP and its implementation impact and alone with that it provides sustenance for the identification of research problems, research objectives, research gaps, variable identification, making of the conceptual model, the making of questionnaire, data analysis and for final discussion.

This chapter of the research work segregated into different sections on the basis of ERP implementation and its impact and also on Information System (IS) /Information Technology (IT) implementation and finally the study presented the identified research gap.

2.2 ERP implementation

This categorization given in the table 2.1 is to bring the literatures on ERP implementation, the process of ERP implementation, Factors Considered prior to ERP implementation, at the time of implementation and after the ERP implementation and all other available literatures to gain information on the execution of the ERP system.

Table 2.1

ERP Implementation

Citation	Objectives	Methodology	Contribution
Yusuf et al., 2004	Issues and risk in successful implementation of ERP SAP R/3 package in a major manufacturing organisation in UK	Case Study	• Project implementation problems are categorized into three a. Cultural, b. Business and c. Technical • Listed the activities that contribute to the overall success of the project
Kotiranta, 2012	Finding the requirements of ERP systems, the functionalities that need to be included in the ERP software and finally identifying the ERP system that satisfies the needs, requirements and resources of the company	• Case Study • Theoretical and Empirical	• It is very crucial to note the experience, references, financial state and attitude of the vendor before selection. • Risk Matrix Model is developed showing the probability of certain risk and its impact.
Fontana and Neto, 2009	Analyze the implementation of ERP systems using a proposed organisational change model.	• Case Studies • Exploratory	• Used complexity theory to understand the ERP adoption • Constructed a model to depict organizations complex structure and dynamics • Classified organisational system into, functional aspect, structural aspect and evolution aspect

Citation	Objectives	Methodology	Contribution
			• Focused on the structural aspect with two subsystems: structural and cognitive sub system.
Vuksic and Spremic, 2005	• To present the effects of information technology (IT) and enterprise resource planning (ERP) systems on business process improvement • To suggest BPR and ERP system modeling framework	• Case Study • Descriptive and analytical	• The tangible and intangible benefits of and ERP system are listed. • Listed the BPR problems in the surveyed companies • Major barriers of BPR project initiation are lack of top management support and high cost of BPR project implementation
Sastry and Babu, 2013	ERP implementation challenges	Descriptive	• Phases in ERP implementation: Pre evaluation screening, choosing implementation partner, As is processed document, to be processed document, Gap analysis, Business blue print, Team training, Testing, Go-live and Post go-live support. • Identified the challenges and significant implementation strategies in each phase of ERP implementation

Citation	Objectives	Methodology	Contribution
Samuel and Kumar, 2013	Prediction of success factors and its contribution	• Case Study • Descriptive	• Developed a conceptual ERP success model • Success factors are classified into three:1. Users- Transaction users, 2. Internal Groups- Top Management, Project team, Positional and knowledge power users and 3. External groups- Vendor and Consultant • The contribution of each success factors are listed
Yang, 2009	• Before and after study of SAP ERP implementation • The current situation of SAP ERP system	• Case Study • Descriptive	• SAP ERP users are divided into i. SAP basic end users or key user ii. SAP controllers or administrator and iii. SAP managers. • Majority of the users are involved and supported the implementation • Identified the missing functions in current package and point out the inefficiency of the current training program and the need of future training courses
Mabert et al., 2003	Comparative study of the companies which implemented ERP "on-time" and/or "on/under budget"	• Case Study • Descriptive	• The classification of companies on the basis of on-time implementation and under budget implementation was

Citation	Objectives	Methodology	Contribution
	with the companies which does not		done with Logistic Regression Model. • The variables are classified under three categories: -Planning effort, Implementation decisions and Implementation management
Hustad & Olsen, 2011	The pre-implementation phase of ERP project implementation in a small and medium enterprises and the critical issues in the process of implementation	• Interpretive Single Case study • Exploratory	• With the support of the project team and the business network of CEO the company made surveys and evaluation of vendors, resellers and ERP packages even they started the implementation in their week position • Agency theory were used to know the unbalanced relationship between agents, resellers, consultants, the principal and the client company
Almajali et al., 2016	Measuring the impact of the antecedents training, supportive leadership, ease of use on user satisfaction and finally the ERP implementation success	Empirical	• Used Structured Equation Modeling (SEM) technique for analyzing the relationship among variables. • There found a strong and significant mediating effect of user satisfaction between ease of use and ERP implementation success

Citation	Objectives	Methodology	Contribution
			• Providing limited resources for training earn only short-term gains and failure in the long run.
Huang, 2016	Identify the declining stage of ERP and the reasons for ERP switching	• Case Studies • Descriptive	• ERP life cycle: a. Diffusion (go-live point), b. utilisation (stabilisation point), c. Enhancement (transformation point), and d. Decline (withdrawal point) • Reasons for ERP switching classified into three layers: Infrastructure layer, Capacity Layer and performance layer • Identified ERP switching strategies: new system with old vendor, new system with new vendor(s), Optimising the current system and Best-breed system
Wu et al., 2007	Identifying the misfit between enterprise requirements and ERP packages, the misfit locations, their significance level and finally the solutions.	• Case Study • Descriptive	• Theoretical base: TTF Theory • The ERP project team in the case study consists of Top Management, MIS staff and Key users • The study made a practical solution in decreasing the problems of goal misfit, functional misfit and data/output misfit in enterprise level, scenario level,

Citation	Objectives	Methodology	Contribution
			activity level respectively in ERP selection between ERP system design and the enterprise's requirements
Seo, 2013	Comparison of large-scale organisation and the university environment by evaluating the Critical Success factor in ERP implementation	• Case Study • Descriptive	• Three phases of implementation- antecedent condition, implementation process and its outcome • The standardization and integration feature of ERP make a rigidity in the university system which increase the workload of university staff and thereby enhance the gap between system and reality. • Both university and organisations expected ROI is not much satisfactory because of the huge cost involved in the implementation.
Dixit and Prakash, 2011	To provide details on ERP implementation effecting issues, challenges and factors	Descriptive	• The customisation level should be less than 30% for an ideal implementation • The transaction processing function and work flow management function of ERP allow integrated data management and management of several processes in

Citation	Objectives	Methodology	Contribution
			an organisation respectively, which finally switch over the functional organization to a process oriented one.
Abdinnour-Helm et al., 2003	In order to gain a better understanding of the "people" side of ERP installation, this article investigates the role of employee attitudes in ERP implementation effectiveness.	Descriptive	• Greater involvement of consultant Pre implementation training and benefits explanation are essential, but isn't always supports the development of positive attitude. • Attitude of employees doesn't have a major impact on ERP implementation, but employees positive attitude gave way to a better result than before
Ash and Burn, 2003	• To analyse the integration of ERP (SAP R/3) system and non-ERP systems using internet. • To identify the factors for success of an e-ERP projects	Embedded multiple case-study	The successful e-ERP projects facilitate most of the business framework components like organisational change environment and technological infrastructure and project management. Where the unsuccessful e-ERP projects are inhibitors in the area like cultural readiness and change management.

Citation	Objectives	Methodology	Contribution
Olhager and Selldin, 2003	To identify the characteristics of firm and the respondents To examine the degree of system penetration, the Pre implementation activities, Implementation Experience, ERP Package and customization, Benefits, Extension to ERP system and Future Directions	Descriptive	• Most of the firms in Sweden implemented the ERP and often from Swedish vendors ie ERP penetration is really high • Most of the implementation and customization happened in the production management modules and secondly to financial flows, but its outcome is poor, but still ERP is extending to different functionality especially to supply chain integration.
Sun et al., 2015	• Identification of different stages of ERP implementation • Classification of CSFs and KPIs into different stages of identified ERP implementation • Performance assessment	• Delphi Method • Dumpster-Shafer combination method • Action Case Study	• Identified Key Performance Indices and also provided weights to these indices using Dumpster-Shafer model • Formulated guidelines for the successful ERP implementation in five stages (ERP organisational readiness, ERP selection, ERP implementation, ERP final preparation and ERP live-run and implemented in three companies
Mandal and Gunasekaran, 2003	Experiences of planning and implementation of ERP in water	• Case Study • Descriptive	• Replace the existing systems with SAP's PS Module rather than

Citation	Objectives	Methodology	Contribution
	corporations in Australia		their repair option which is costly • The implementation faced only minor problem. • The strategies adopted by the water corporation in the pre implementation, implementation and post implementation believed to make the implementation successful, which is listed for references.
Zaglago et al., 2013	Identification of significant cultural factors which effects the ERP implementation	Descriptive	The identified cultural factors-mismatch with local culture are lack of ownership culture, management culture, cultural change, cultural fragmentation in the market place, cultural readiness, subculture diversity, information flow, communication culture, sectorial differences, gender segregation and inpatient culture.
Ahmadi et al., 2015	• Factors influencing ERP implementation readiness and its interrelationships • Development of readiness assessment model	• Analytical • Fuzzy Cognitive Maps (FCM) method	• Identified three readiness dimensions- organizational, social, and technical readiness and the study concentrates more on the organisational readiness dimensions • To develop the assessment model, an interrelationship

Citation	Objectives	Methodology	Contribution
			between activities with four nodes (organisational, technical, social and total readiness node) are formulated with Fuzzy Cognitive Maps (FCM) method
Rajan and Baral, 2015	Impact of various factors on ERP usage and its effect on ERP users.	• Empirical • Partial Least Square method is used to analyse the data.	• The role of different individual factors like computer self-efficacy, certain organizational and technological factors got a major role on the use of ERP. • The identified factors in the study created a panoptic empowerment in employees and it also enhanced individual performance. • The convergent and discriminant validity demonstrated the measurement model's strength
Salimi, 2005	• Differences between service and manufacturing sector • Differences in Key Critical or Success Factors (KCSF) in the ERP implementation process in manufacturing and service sectors.	• Case study • Empirical	• Identified eleven KCSFs. • The requirements like the preparation of business process, people and technical systems and change management competencies and project management while implementing ERP makes the differences in the ERP implementation in

Citation	Objectives	Methodology	Contribution
			manufacturing and service sectors • The Management involvement and manufacturing complexity lead to success or failure of ERP in the manufacturing units and management involvement and strength of corporate culture influences the success or failure in Service sectors
Kilic et al., 2015	Tools adopted by the SMEs in selecting the best ERP software packages from several alternatives and the study mainly focus on the adoption of the ANP (Analytical Network Process) weighted PROMETHEE (Preference Ranking Organisation Method for Enrichment Evaluation) tool in selecting the software	• Empirical Study • The combined methodology based on ANP and PROMETHEE tools provides the best method for ERP evaluation.	• The proposed methodology suggested that the first step of the ERP selection is the pre-evaluation to determine the criteria of ERP selection and its relationship and next is the use of ANP by providing weights for different criteria by making comparison by the experts and the last step is the utilization of PROMETHEE tools which provide rank according to the weight assigned by the ANP tool to recognize the best alternatives of ERP suppliers • From the study it found that cost is the most important criteria in selecting a vendor, so the

Citation	Objectives	Methodology	Contribution
			decision to select an ERP supplier mostly determined on the basis of its economic impact.
Pattanayak & Roy, 2015	• CSFs for BPR implementation • Factors effecting the synergy of BPR with ERP	• Case Study • Empirical Method	• Isometric working model helps in aligning BPE values with ERP • The model highlighted the seven important levels in embarking BPR on ERP
Ram et al., 2013	The impact of CSFs on the ERP implementation success and in obtaining the performance improvement of the organisation	Empirical Method	• From the identified four factors Project management and Training and Development have a major role in implementation success while system integration is not so critical but BPR is critical in some organisation and not in some others. • Partial Least Square (PLS) or Component Based Structural Equation Modeling was used in order to estimate complex models. Cronbach's alpha also used
Nah and Lau, 2001	The most influencing CSFs for a successful ERP implementation	Descriptive	• CSFs are classified on the basis of process theory of Markus and Tanis (2000) • Identified eleven factors as most critical in successful ERP

Citation	Objectives	Methodology	Contribution
			implementation like teamwork and composition, top management support, effective communication, efficient project management, broad BPR and minimum customization, software development-testing-troubleshooting
Li et al., 2017	• Critical success factors for ERP system through the life cycle of ERP for achieving the outcomes of Information Technology governance. • The association between CSFs and the three drives Strategic Alignment, Resource Management, and Risk Management of Information Technology Governance.	• Conceptual • Identified a performance measurement index for providing value to CSFs.	• 35 CSFs are aggregated, classified and ranked as per priority • Provided guidance in maintaining ITG for managing the CSF in the different phases of ERP and also to reduce the problems relating to IT risks
Upadhyay et al., 2011	Success factors in implementing ERP in Indian MSMEs	Empirical	The four important critical success factors in implementing ERP are Project execution competency, package and vendor perspective, organisational climate and technical

Citation	Objectives	Methodology	Contribution
			perspective or infrastructure
Pabedinskaitė, 2010	Important factors for successful ERP implementation	Empirical	• Identified sixteen success factors classifies under three categories: Internal Factors, External Factors and Mixed factors • Data collected from ERP Experts and ERP users, which are compared to get a clear picture of the essential factors
Al-Mashari et al., 2003	Taxonomy for critical factors which influences the successful implementation of ERP	Conceptual	• The taxonomy for the CSFs has been developed on the basis of Business Process Management Principles • The ERP CSFs has been classified in three phases:1. Setting up (CSFs-management and leadership and visioning and planning. 2.Implementation (CSFs-ERP package selection, training and education, systems integration, communication, project management, systems testing, process management, legacy systems management and cultural and structural changes).3. Evaluation (CSFs-

Citation	Objectives	Methodology	Contribution
			performance evaluation and management.) • ERP benefits classified into Operational, Managerial, Strategic, IT infrastructure and Organisational benefits • Established the organisation's need of evaluating the non financial performance along with the operational measures.
Kalbasi, 2007	The CSFs and its impact on ERP implementation.	• Case Study • Empirical	• Identified nine CSFs • Recommended minimal customization • Project team- cross functional, mix of consultants and internal staff, team possess both business and technical knowledge, need compensation and incentives and team dedication is significant • "People element" is most crucial for the success of ERP implementation so training is essential • System testing is must before go-live, troubleshooting errors if required, data migration and data clean up if required

Citation	Objectives	Methodology	Contribution
Sternad and Bobek, 2006	CSFs for successful ERP implementation.	Conceptual	Identified factors: Clear Goals, Objectives, Scope and Planning, Project Team, User Training and Education, Business Process Reengineering, Change Management, Effective Communication, User Involvement, Data Analysis and Conversion, Consultants, Project Management, Project Champion, Architecture Choices (Package Selection) and Minimal Customisation
Al-Fawaz, 2012	• The factors which influence ERP adoption and implementation in SSOs • Life cycle of ERP implementation and the factors which influences different stages of ERP implementation • To propose and evaluate an ERP adoption and implementation model	• Case Study • Empirical • Analytical hierarchy • Process (AHP) technique is used to analyse the importance of one factor over the other	• Developed a conceptual model highlighting five significant factors and its subfactors • Factors: a. Stakeholder factors includes top management commitment, external advisory support, vendor partnership and end user involvement, b. Process factors includes BPR, customization approach and performance measurement and control, c. Technology factors include Package requirement

Citation	Objectives	Methodology	Contribution
			and selection and system testing d. project factors include project management, budget-cost parameters and Time, e. organisation factors include change management, effective communication, organization structure and culture and training and education • Analytical hierarchy Process (AHP) technique is used to analyse the importance of one factor over the other
Rahman and Saha, 2015	• Factors influencing ERP implementation and its analysis to evaluate its impact on the successful ERP implementation • Potential values and threats of ERP implementation which effects BPL long run functions	Conceptual	• ERP implementation phases and success factors: i. Early implementation phase- package selection, implementation time and plan etc. ii. Implementation phase-legacy system management, consultants, vendors and customer relationship, deviation handling and cutover etc. iii. Post implementation phase-post evaluation, maintenance and upgrade and Audit • Proper auditing program, adequate training and testing and post

Citation	Objectives	Methodology	Contribution
			implementation evaluation is necessary to get the whole advantage of ERP
Umble et al., 2003	• CSFs • ERP Software selection steps • Procedures for a successful implementation	• Case Study • Conceptual	• Nine CSFs like Clear understanding of strategic goals, organisational change management, commitment by top management etc… • Explained thirteen steps to select the appropriate ERP software package and eleven ERP implementation steps which includes pre implementation review, software implementation and pilot study, training, security and ensuring data accuracy
Al-Sabaawi, 2015	CSFs	Empirical	Identified Eight CSFs and it was found that Project management, technological infrastructure and commitment and support of top management are the most important CSFs for fruitful implementation of ERP
Huang et al., 2012	ERP Cusomisation-Decision factors from consultants perception	Case Study	Different aspects of Customisation and factors considered under each aspect - Data structure aspect (Factors-Critical

Citation	Objectives	Methodology	Contribution
			demand for production customization and Commonality demand), system function aspect (Factors- Acceptance of higher customization charges and increase consultant's output value to achieve performance, and report output aspect (Factors- good communication among two parties and focus on future benefits)
Nyrhila, 2015	Barriers in master's data quality maintenance in the data migration especially sales and distribution related master data	Descriptive	• Identified the people related and process related barriers of data quality in the procedure of data migration. Recommended the strategies and the most intrinsic data related, people related and process related methods to enhance the master data quality
Lee & Lee, 2004	ERP effectiveness on firms Information capabilities	Empirical	• Change management is a mediating variable and got a significant role in developing the information capabilities in ERP success • The strongest variable on enhancing the change management effectiveness in ERP

Citation	Objectives	Methodology	Contribution
			implementation is Organisations Citizenship Behavior. • The IS innovation resistance acted as a barrier in the initial stage of ERP implementation but gradually its influence on effective change management reduced.
Andersson and Olandersson, 2013	ERP vendor and consultant relationship and it effects in consultant role	Empirical	• Pindownth ERP vendors consultancy supports in the client organization • Strategies adopted in implementing ERP in different stages by the case companies • Showing differences in the role of consultant among case companies with separate consultant and vendors and case companies having vendors with a partner consultant
Martinovic and Delibasic, 2014	Finest SAP ERP Consultant selection with the support of combined AHP-IBA Model	Combined AHP-IBA Model	• There may be conflicts or there may be interrelations in between the criteria identified for selecting the ERP. This cannot be rectified with the traditional AHP model, in order to tackle this issue, the study applied IBA Model to expand and generate new criteria. Thus, by combining the AHP-IBA model

Citation	Objectives	Methodology	Contribution
			the organization can select a consultant from the alternatives available.
Vayvay et al., 2012	Selection of the best ERP consultant by using PRP, AHP, Fuzzy AHP and ANP	PRP, AHP, Fuzzy AHP and ANP Model	• Criteria for selecting consultant are sub categorized into nine under four categories which are: i. Cost- Transportation Cost and Consultancy Cost. ii. Work Experience- Companies employed, Projects Completed and References. iii. Education Level- Department Graduated and Occupational Seminar. iv. Communication ability- Awareness of Responsibility and Ability to Persuade
Sudevan et al., 2014	1.The role of stakeholders in successful ERP implementation. 2. the key factors and stake holder's relationships.	Analytical	• Eleven key factors identified includes commitment by top management, organisation change management and extensive training and education. • A huge percentage of employee attrition rate was found, mostly the trained staff: - Result: shortage of key personals • The user resistance to change attitude decreased due to effective and frequent top management

Citation	Objectives	Methodology	Contribution
			support and commitment. • Most of the oragnisations divided employees into three stakeholders' group- Top management, middle management and end users • User satisfaction can enhance by involving the end users in the ERP implementation life cycle.
Dezdar and Ainin, 2010	ERP system quality and ERP vendor support	Descriptive	• The system quality and the vendor support are the two factors in the context of ERP system environment which have a positive impact on user satisfaction which subsequently impacts the organizational performance • The identified vendor support activities are user training, technical assistance, emergency maintenance, updates, service responsiveness and reliability.
Tambovcevs and Merkuryev, 2009	ERP implementation issues, ERP implementation process, Key success factors and risk factors	Descriptive	• Listed the cost involved in each phase of ERP system life cycle • ERP system implementation process is classified into six stages:

Citation	Objectives	Methodology	Contribution
			Initiation, Adoption, Acceptance, Routinisation and Infusion • The identified stakeholders of ERP implementation are Developers, Management, Consultants and users
Magnusson et al., 2004	Forecasting the success of ERP implementation, framing a conceptual model for such forecasting	Descriptive	• The percentage of the probability of success forecast on the basis of fulfillment of number of factors among the identified sixteen factors • The identified sixteen factors are reorganized under four categories, i.e. Top Management, Project, Organisation and System

2.3 ERP implementation Impact

This division of the literature reviews provided in the table 2.2 are based on the influence or impact of the ERP implementation on the outcome pf the enterprises. The study tried to focus on both quantitative and qualitative outcome.

Table 2.2

ERP Implementation Impact

Ranganath and Brown, 2006	Stock market returns to ERP investment i.e., the firm's value of ERP investments on the basis of functional scope, physical scope and the ERP package vendor	Case Study	• Event study approach is used to analyse stock market changes as a result of changes in business on the basis of capital market theory and the efficient market hypothesis. • The ERP adoption resulted in greater functional scope and physical scope shows a positive abnormal stock market return and increased the firm's value than ERP projects with lesser functional scope and physical scope. • The dominance status of ERP vendors has no influence on the value generation of firms on the other hand it is influenced by a suite of modules of vendors.
Hitt et al., 2002	Impact of ERP implementation on the productivity and business performance considering the financial data, i.e., the economies of ERP implementation.	• Case Study • Theoretical and Empirical	• The performance of the firms is measured by performance ratio analysis, productivity and stock market valuation. • The business performance of ERP adopters is much higher than the non-adopters, but some data are showing a reduction in performance and productivity

			immediately after implementation. • Financial market showing a higher rate to companies adopting ERP even in the long run as the adoption risk is lesser than the expected value.
Galy and Sauceda, 2014	Technological competence, a relationship with experts and consultants, top management support, long range plan and written objectives, knowledge and the information sharing between departments and its effect on financial performance.	• Case Studies • Exploratory • Econometrics for data analysis	• Data collected one year prior to ERP implementation and four years following implementation from 50 companies • . The financial performance calculated with NS, Net Income Before extraordinary items and preferred dividend, EBIT, ROA and ROI • In the implementation year and the next year ROI was negatively affected, but after two years of the implementation it showed a positive impact on ROI • Technical competence has a direct relationship on net sales, relationship between outside experts and consultants have a positive impact on EBIT, ROA and ROI, information sharing between departments make changes in NIB, ROA and ROI, top management emotional support and knowledge

			have no significant effect on NS and NIB • The study concluded that the success of ERP implementation can analyse with the financial ratios
Poston and Grabski, 2001	Comparing post selling, general and administrative cost, residual income, number of employees and cost of goods sold with the pre implementation stage.	• Case Study • Descriptive	• Selling, General and Administrative cost doesn't reduce in the first 3 years immediately after implementation comparing to the pre implementation stage • CGS shows a decrease from the third year comparing to pre implementation • RI doesn't show a hike in the three years immediately after implementation. • Number of employees decreased in three years immediately after implementation and it showed an improvement in firm's performance. • No difference identified in the performance of manufacturing units and service units.
Ahlawat and Punam, 2011	comparison of ERP users and non-users among ERP implemented organisation (Manufacturing, Finance and services)	Descriptive	• No significant performance difference between ERP system users and non-users at the business process level or at the overall firm level • In the initial period after the implementation the overall firm performance was higher,

			but nothing happens to the business process performance • The ERP users doesn't show a significant higher performance at a core business level and at firm level comparing to non-users • The person with longer experience of ERP systems, contributed on firm performance and on business process performance • Suggestions- changes should adequately informed to users, users' participation in the development and implementation of ERP system should ensure and the business process reengineering activities while implementing ERP will support the users in getting and sharing technical and business knowledge.
Ali, and Irfan, 2016	A comparative study a. On financial performance of adapters and non-adapters b. Operational benefit and strategic benefits of adapters and non-adapters c. On performance in the pre and post	• Case Study • Descriptive	• Financial ratios which are used for evaluating financial performance are Return on Asset, Return on Invested Capital, Return on Equity , Return on Sale, Total Asse Turnover, Selling General and Administrative Expense, Cost of Goods Sold, Account Receivable Turnover, Inventory Turnover, Profit Margin, Operating Income, Sales Growth, Leverage of the

	implementation of adapters d. Cost of non-adoption		firm and Operating Expense • There is an increasing trend of financial performance of adopters than non-adapters due to the increase of OX and COGS and also the cost of not investing in ERP declines the financial performance of non-adapters. • A frame work was developed in order to evaluate the cost and benefits from adopting ERP
Brynjolfsson and Yang, 1999	Higher stock value due to the role of computer complementing the unmeasured intangible assets in the balance sheet	• Case Study • Descriptive • Econometric model	• Computer capital enhances the outcome more than any other plant and equipment but this is not the only result of computers but also with its supporting intangible assets • The financial market value of firms which installed computer capital is ten times greater than any other conventional assets
Zhang et al., 2012	• ERP implementation and company performance, especially the time lagging on getting return on investment • TobinsQ used to measure the company's performance	• Case Study • Descriptive and Analytical	• Even implementation enhance firm's performance it takes a long period to recover the investment cost • Tobin's q doesn't show any changes in the first three years of implementation, but an increase happened in the fourth year, which reflects the effect of

			ERP happens only in the long run
Parto et al., 2016	The implementation effect of each ERP modules and ERP system as a whole on the financial performance of firms in Iran	• Interpretive Single Case study • Exploratory	• Extensive use of ERP modules enhances the financial performance and the biggest contribution is from human resource module • The wholistic ERP implementation is contributing more to financial performance than the individual modules and also the extensive individual modules • Four important financial measurements ROI, ROA turnover volume and net profit margin • Small samples and large variables-partial least square (PLS) method is used
Hunton et al., 2003	• Longitudinal impact on financial performance of ERP adopters (pre and post implementation comparison) and non-adopters • The effect of firm size and firms health on the financial performance of ERP adopting firms	Empirical	• Firm performance is more to adopters than non-adopters • Large/unhealthy and small/healthy adopters performance is significantly larger than large/health adopters and small/unhealthy adopters • Accounting measures used to measure the financial performance- a. Return on Assets-Return on Sales and Asset Turnover b. Return on Investment.
Kallunki et al., 2011	The extend use of ERP and the	• Case Studies	• Positive relation between extensive use

	mediating role of formal and informal MCSs to improve financial and nonfinancial performance of the firm	• Descriptive	of ERP and firms performance with MCSs as mediating role except for informal control and also find that the non-financial performance improvement will lead to improvements in financial performance.
Maas, 2015	Knowledge management, impact of control and empowerment, changes in users' behavior and Business Analytics in the Post implementation phase of ERP	Empirical	• Key users got a significant role in efficient usage of the ERP system through proper knowledge management • Control empowerment and work commitment directly influence the ERP end user behavior efficiently • Identified the need of ERP knowledge (process, organisation and software knowledge) in the different organisational levels.
Hwang, 2011	• ERP implementation-Driving Factors • ERP implementation outcome • The mediating variables between ERP implementation and firms' performance CSFs	• Empirical • The Q - sort methodology was used to sort items in separate sub-construct	• Theory base-contingency theory, resource-based view of the firm theory and dynamic capabilities theory • Integration, configuration, adaption and user training are the significant variables to be considered at the time of implementation • Contributed a Research Model showing the relationships of internal and external factors on ERP implementation

			and its impact on supplier and organizational capability and performance and ultimately the impact of supplier and organizational performance on customer value
Dantes and Hasibuan, 2011	The exploration of the strategic and tactical impact of ERP implementation	Empirical	• The companies adopted the ERP implementation due to the external forces rather the business needs • The ERP implementation success had been evaluated with the variables Budget, Project Time, Performance, Benefits • The implementation of ERP in the selected industries has a more important impact on tactical, instead of strategical. • Spearman Rank Test had been used to identify the impact of ERP on Strategic and Tactical level of the organisation
Akkermans et al., 2003	The present and future impact of ERP on SCM and find the key limitations to make improvements	Exploratory and Delphi method	• The key trends in SCM • The mild role of ERP in solving the issues in supply chain and its effectiveness. • The risk with the adoption of ERP and its negative effect on SCM developments
Tian and Xu 2015	The post implementation	Descriptive	• Compustat database variable used for

	stage of ERP to know the effect of the presence of ERP system on the firm's risk		measuring firm risk and for ERP variables Computer Intelligence database are used • The presence of ERP and by widening the scope of ERP in a more uncertain environment show a strong reduction in the risk of the firm and thereby enhanced risk adjusted market return of firms • ERP system impacts the performance volatility even at the micro level
Rambabu et al., 2013	The management of the production process and life cycle of a product by integrating SAP with product life cycle management (SAPPLM application-SAP Product Lifecycle Management application) tools for acquiring maximum result i.e., by overcoming the pitfalls of legacy system.	Case Study	• Industries are using Advanced Product Quality Planning for new product designing and development process and it is mandatory for a vendor • The virtual collaboration facility maintained by the SAPPLM project system application helps the company in getting the items on schedule time, quality and cost of the vendors. • SAPPLM engineering change management (ECM) supports the changes in the part of the product within the project schedule. • The SAP integrated PLM deliver high quality products, reduce waste, accelerate product development, improvements in operations, optimize

			productivity, cost tracking by comparing budget, time tracking, document management by providing single database, support management for decision making.
Karimi et al., 2007	The role of business process and project management knowledge, relationship (sharing risk and responsibility among top management and users) and IT infrastructure resources on business process outcome by building ERP capabilities	Descriptive	• The knowledge resources are crucial in building ERP capabilities with importance to relationship resources but more than infrastructure resources. • The firm should not consider the resources separately in isolation with each other, but should consider collectively enhancing ERP capabilities and thereby improving the business process outcome. • For the comparative analysis of resources, the moderator model versus the baseline model is used.
Muinde et al., 2016	The impact of organisational structure (mainly focusing on the decentralized structure) on the knowledge sharing or knowledge management that may lead to ERP implementation failure or success in the	Descriptive	• To know the relationship between variables and the strength and directions of the relationship, Factor analysis test, multivariate regression analysis, correlation analysis, univariate analysis is used. • The centralized form of organisation structure is so rigid, which results in

	organisations listed in the Nairobi Security Exchange in Kenya.		hindering the ERP implementation success • The decentralized organisation structure which will enhance the knowledge sharing among different functions, units and individuals which leads to a successful ERP implementation project.
Shen et al., 2016	Evaluation of ERP performance in the post implementation stage focusing on financial, customer, innovations and learning and Internal business process.	Descriptive	• The ERP evaluation framework integrated with the Hierarchical Balance Score Card is used for measuring performance and to know the contribution of ERP to the strategic decisions and objectives of the firms
Ranjan et al., 2017	To explore the relevance and strategic benefits of ERP emerging technologies in connection with large manufacturing enterprises and OEMs	Exploratory	• Eight benefit factors were identified as per the relevance to the objective indicators (employees, process, customer and finance) and their corresponding transformation driver
Madapusi, 2008	The changes happened in firm's performance due to ERP implementation and the role of CSFs as a moderator of ERP implementation and firm's performance.	• Case Study • Descriptive	• Implementing different modules make differences in performance and contribution of CSFs also make differences in performance that a difference in implementing a holistic ERP package • The firms who take the contribution of critical

			success factors only in the initial stage of system deployment achieve lesser benefits while that of firms which emphasize the CSFs on the whole process of ERP implementation
Seddon, 2005	The evaluation of the benefits from ERP investments and its role on enhancing competitive advantage	Descriptive	• Operational effectiveness: • -Better information • -Modern integrated platform • -Cost savings • -Improved business process and productivity etc. • In case of some organizations, it's not clear that the cause of competitive advantage is due to ERP system, but evidence from most organizations clearly shows the role of ERP in enhancing competitive advantages
Tsai et al., 2010	• Consistency between system and business process in ERP package selection • BPR and its impact on ERP implementation performance • Gap between the system and business process and its impact	• Case Study • Descriptive	• BPR is showing high degree of ERP implementation performance than software customization • ERP system perform high when there is no gap between business process and the system • If there is consistency between system and business process the company should ignore the customization part of software to match

	on ERP implementation		business process to get better performance
Bishnoi, 2011	• Cost –benefits of ERP implementation • Impact of ERP implementation • CSFs of ERP software	Descriptive	• cost benefit analysis- parameters- Net Annual Benefits, Cost-Benefit ratio, Pay Back Period and ROI • Eight ERP implementation phases i. Project scope,ii. System analysis, iii. Prototyping, iv. Construction, v. System integration, vi. System accepting and testing, vii. System change over, viii. System evaluation and maintenance • Tangible and Intangible benefits of ERP system was identified. • Cost variables for ERP implementation: hardware cost, licensing cost, training and knowledge transfer cost, personnel/ consultants cost and cost of professional services (customization, integration, data conversion, testing, training)
Ram et al., 2014	The antecedent factors of ERP implementation for achieving competitive advantages	Conceptual	• Perceived system quality, Perceived Information Quality, Organisational Readiness, Environmental Assessment and Perceived Strategic Value are identified as the important factors to

			determine the competitive advantage • Information quality will not create value but its effective usage will.
Hwang et al., 2015	• The effect of ERP implementation in the result of organisations performance based on the manufacturing units in Korea. • The influence of ERP implementation strategy on IT enabled combinative capabilities • The influence of IT enabled combinative capabilities on competitive performance outcomes • The mediating role of IT enabled combinative capabilities on ERP implementation strategy and competitive performance outcomes	Descriptive	• The research model consists of ERP implementation strategy (adoption, configuration, integration and user training), IT-enabled combinative capabilities (cross-functional coordination, process improvement, agility and information access) and competitive performance outcome (cost performance, quality, time to market and product variety) • For ascertaining the possible relationship and to test the hypothesis SEM framework is used. AMOS software was used for further exploration of relationships. Chi square and t-test are used for analysis. • It is found that the ERP system implementation strategy and IT-enabled combinative capabilities have a strong direct relationship

Source: Literature Reviews

2.4 IS/IT Implementation

Even the study is required to focus on ERP implementation and its impact, the study also made some reviews on the implementation of Information Technology (IT)/ Information System (IS). Which is presented in the table 2.3.

Table 2.3

IS/IT Implementation

Dharni, 2010	• Type of IS and extent of its uses- manufacturing units, Punjab. • Variation in IS uses in the different management levels and functional areas • Practices used for outsourcing and implementing IS practices • Evaluation of IS	Descriptive	• Identified seventeen factors which effects the selection of IS and vendor • Feasibility study, level of customisation, change management activities including BPR, project management, method adopted for user training and use of consultant are considered to find the effectiveness • Evaluation of IS performance was derived from twenty statements in the questionnaire and with factor analysis seven dimensions was identified to evaluate the performance – reliability and speed, accuracy and adequacy, user ability, ease of use, facilitation for work, maintainability and flexibility.

Lange et al., 2011	Replacement of the traditional data center infrastructure technologies or outsourcing to cloud computing- from the point of view of business executives (surveyed 489 business executives)	Descriptive	• Examines the innovative features of cloud providers • The problems of cloud providers in the dual role of managing the traditional IT outsourcing still the transition completes at the same time managing the new cloud system • Risk factors like the security issues in public clouds and data and system portability risk • Awareness of enterprises about the benefits of the new system • Cloud computing will be effective only if it is embed efficiently into the organisations archtectural fabric
Ruhse and Baturova, 2012	The adoption of cloud computing in the light of case studies and examples	• Case Studies • Descriptive	• Challenges in accepting cloud services: internal and external data security, national and international data protection laws, strategic alignment with IT and business, organisational IT governance, risk management and compliance requirement • Key success factor: Strategic alignment between business and IT

Source: Literature Reviews

2.5 Research Gaps

Enormous studies have been contributed to the literature which sheds light into the concept of ERP implementation. Considering the significant literatures on ERP implementation, the study found that many national and international literatures went through different critical factors associated with ERP implementation and various processes adopted by different organisations in implementing ERP systems in their respective concerns. Along with the identification of Critical factors in ERP implementation, it is critical to analyse the real outcome of ERP, so the study gathered literatures on the impact of ERP implementation. After reviewing the literatures on ERP implementation impact on the organisations, it was found that there are both national and international literatures on the impact of ERP. The outcome of the implementation was verified in both financial and non-financial terms. It was also found that most of the international studies were focused on the financial impact of ERP apart from Indian studies, which concentrated on the non-financial aspect. Most of the studies focused either on financial aspect or on a non-financial aspect. Only limited studies analysed the outcome of ERP in both financial and non-financial terms. Hence, the study found that it is relevant to study the impact of ERP implementation, as there are limited literatures on identifying the CSFs in the process of ERP implementation and the impact of these CSFs on the outcome of the organization both in financial and non-financial facet in Indian context. From the literatures, it also found that the Project Cost and Project time also make differences due to the impact of the CSFs in the process of ERP implementation. Hence, the study also tried to analyse the impact of CSFs on the Project Cost and Project time. Thus, the study examined the major four impact aspect i.e., the organizational capability, the financial performance, the project Cost and Project time.

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Chapter Three

ERP – AN OVERVIEW

3.1 Introduction

3.2 ERP-Definitions

3.3 Need of ERP

3.4 Evolution of ERP

3.5. ERP Vendors

3.6 ERP Implementation Approaches

3.7 Modules of ERP

3.8 ERP Market

3.9 Cost of ERP Implementation

3.10 Issues and Challenges in ERP implementation

3.11 Research Models for ERP

3.12. Summary

3.1 Introduction

This chapter discusses the theoretical base of the research topic. It gives an overall view of ERP by providing the basic information on ERP like its definitions, needs, evolution, cost of ERP, ERP vendors, modules etc. It also gives an update on the recent ERP market.

3.2 ERP-Definitions

Desai and Srivastava (2013) described the term Enterprise Resource Planning by categorising into Enterprise, Resource and Planning

i. Enterprise: Leon (2014) defines enterprises as a group of people who have a common goal and have a set of resources at their disposal to achieve that goal. According to Desai and Srivastava (2013) It can be a company, an organization, an institute, a partnership, or a governmental agency. It is an assembly of people, equipment, data, policies and procedures that exist to provide a product or services, often with the goal of making profit.

ii. Resource: In the words of Ray (2011), resources includes Human resources (manpower), capacity (machines, plants, warehousing, etc.), inventory resources (finished goods and raw material stock), and so on. For any institution, the most challenging thing is the effective use of these resources to create the best possible value for all its stakeholders (its employees, shareholders, etc.)

iii. Planning: Long-term preparatory program that works upon the systematic actions that are to be taken to achieve business goals.

Vaman (2007) defined ERP as a massive software engine that aims to provide a single, seamless interface to all departments, systems, and existing data within an organisation, as well as assisting each department in understanding how it fits into the organization's macrostructure and how it impacts that macrostructure.

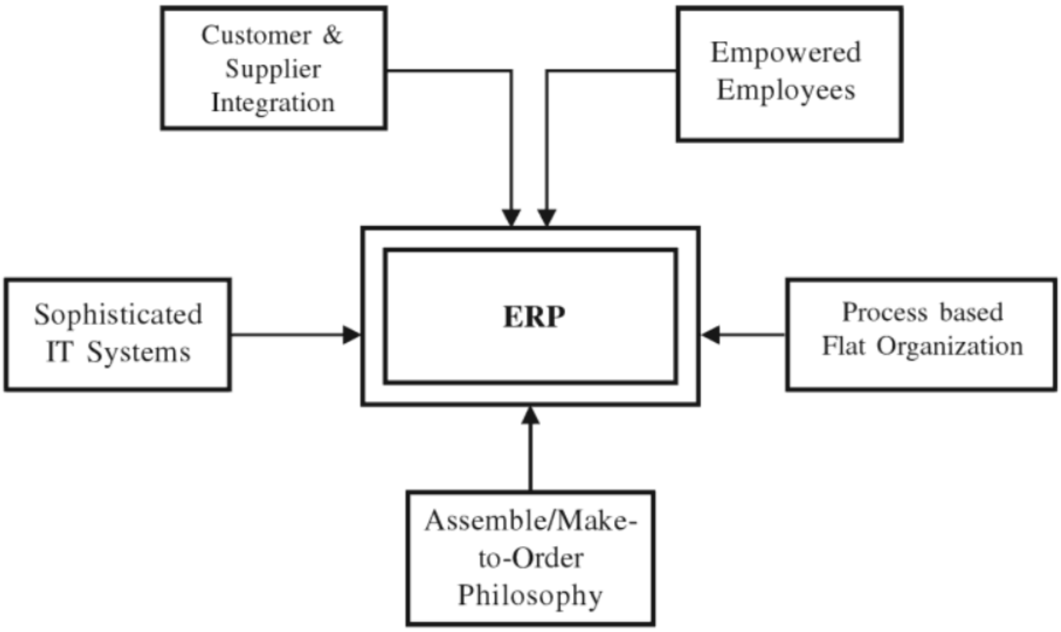
In early 1990's, Gartner, Inc., a Stamford based technology research and consulting company introduced the term Enterprise Resource Planning as the *next generation of integrated manufacturing software* and explained it as an extended version of MRP and MRP II. Thus, in 1990 ERP evolved from MRP II of 1980's by expanding the definition of MRP II and this was considered as the first Era of ERP.

Altekar (2005) defined ERP as the finest expression of how information technology and business are inextricably linked. An enterprise-wide system with supporting technology and an effective management tool is required for integrating all levels and boosting reportability.

Altekar (2005) developed a conceptual model for ERP, which is given in the figure 3.1

Figure 3.1

Conceptual ERP Model: Pillars of ERP



Source: Altekar, R. V. (2005). *Enterprisewide Resource Planning.* New Delhi: Prentice-Hall of India.

3.3 Need of ERP

Every organization is doing business in its own way. Each organization is unique. So, one organization's need is different from that of another. But the decision to implement ERP is based on common issues or challenges. Schwarz (2016) points out such issues or problems or frustrations, which stimulate the organisation to become ready for implementing the ERP system. Schwarz (2016) noticed some of such common issues among the business to take a major ERP implementation decision.

1. Usage of different software for different functions or business processes: By using different methods or software for different processes of business, it will generate integration issues which hinder the flow of information within the organisation and outside, which ultimately affect the sales and profit thereby the growth of the business. Through ERP implementation, the organisation can depend on a single database.

2. Issues in easy access to information. Traditionally, to get a holistic view of the business the organisation needs to wait a period of time. But ERP system can provide the reports at any point of time.

3. Long time for accounting: An ERP system will make a significant impact on getting the financial reports on time.

4. Sales forecasting issue and lack of customer satisfaction: It is the biggest challenge of an organisation to ensure the availability of right product at the right place at the right time when the customer data, inventory and sales are kept separately. ERP implementation mitigates such issues and helps in enhancing customer satisfaction and to retention.

5. Time consuming and too complex IT system: maintaining multiple system makes the system customisation, system integration and upgradation costlier, sap resources and critical time.

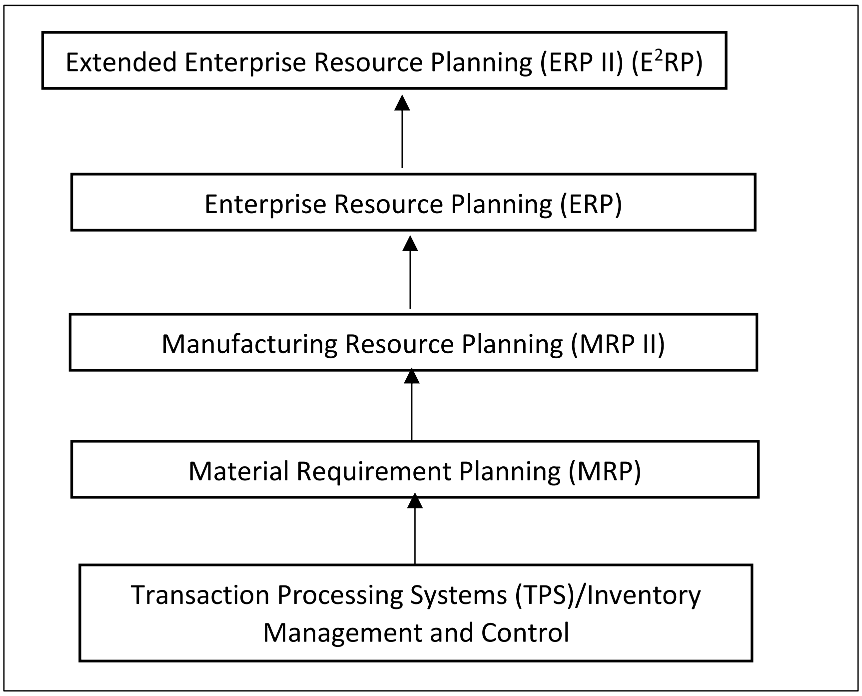
3.4 Evolution of ERP

Prior to 1960's ultimate objective of the organization was the smooth functioning of the organization with the traditional way of inventory management thereby enhancing the business outcome. During the 1960s and 1970s most organisations designed silo systems for their departments but when the operations become bigger, they implemented centralised production systems to automate their inventory and production management with programming languages as COBOL, ALGOL, and FORTRAN (Motiwalla and Thompson, 2009). With the efficacy of the developed centralised production system, the development expanded to the area of production planning and control which gave birth to MRP in the mid-1970s. Then the MRPII was introduced in 1980s with an emphasis on optimizing manufacturing processes by synchronising the materials with production requirements. From the 1960s to the 1980s, the industrial economy shifted drastically to an information economy, with information being regarded as a valuable resource (Bansal, 2013). In these eras, the industrial economy transitioned from Transaction Processing System (TPS) to MRPII and later in 1990s, the era of ERP had started due to the requirement of an integrated solution to the complex business environment. The present ERP II integrates the inter-organisational systems as business-to-business (B2B) and Electronic Data Interchange (EDI). The ERP II is also known as E^2RP i.e., the extended ERP, which embrace other business extensions such as supply chain management (SCM) and customer relationship management (CRM), Enterprise Performance Management etc. to gain competitive advantage (Seo, 2013). Thus, the ERP system transferred the mainframe and centralized legacy application to a client-server architecture with more flexibility using a Web platform.

Figure 3.2. illustrates the evolution of ERP, which is adopted and developed from the studies of Bansal (2013), Motiwalla and Thompson (2009) and the table 3.1, shows the evolution by Motiwalla and Thompson (2009).

Figure 3.2

Evolution of ERP



Source: Bansal, V. (2013). *Enterprise Resource Planning A Managerial perspective.* Noida, India: Dorling Kindersley (India) Pvt Ltd.) & Motiwalla, L. F., & Thompson, J. (2009). *Enterprise Systems for Management.* New Delhi: Dorling Kindersley (India) Pvt. Ltd .

Table.3.1

ERP Evolution

Timeline	System	Description
1960s	Inventory Management and Control	A System designed to efficiently manage and track inventory of raw materials and also guiding on purchase orders, alerts, targets, providing replenishment techniques and options, inventory reconciliation, and inventory report
1970s	MRP	The system designed for job scheduling process and generates schedules for production planning, operations control, and inventory management. The system also focuses the sales and marketing function.
1980s	MRP II	With a focus on manufacturing strategy and quality control, the system supports in designing production supply chain process- from product planning, parts purchasing, inventory control and overhead cost management to product distribution.

Timeline	System	Description
1990s	ERP	The system designed for enhancing the performance of the internal business process across the complete value-chain of the organisation. It integrates the primary business activities like product planning, purchasing logistics control, distribution, fulfilment, and sales. The system also integrates the secondary or support activities like marketing, finance, accounting, and human resources. It focusses on application integration and customer service.
2000s	ERP II	This is an inter-organisational system ready for e-business operations with the client-server using the web platform. It provides anywhere, anytime access to the organisation's resources and their partners. The system integrated with the fifth-generation application like SCM, CRM, SFA, APS etc…It also focusses on agility and customer centric global environment

Source: Motiwalla, L. F., & Thompson, J. (2009). *Enterprise Systems for Management.* New Delhi: Pearson Education.

3.5. ERP vendors

Panorama Consulting solutions (Panorama, Panorama Consulting solutions, 2019), one among the leading ERP consulting and market research firm, yearly conducts an in-depth study on *the titans* of the ERP software industry i.e., the SAP, Oracle, Microsoft Dynamics and infor known as *Clash of the Titans* and in 2019 the research result was SAP is still foothold in the fortune 500 ERP vendors and among the four vendors 30% of the clients selected SAP followed by Microsoft dynamics, Oracle and Infor with 29%, 25% and 16% respectively. While taking the duration of implementation, the Panorama (2019) found that SAP has taken the longest duration with 14.7 months and the least duration by Infor with 11.2 months, the remaining titans took 12 months for the implementation. Likewise, Panorama (2019) also discovered that the implementation disrupted the business operations, the leading ERP vendor SAP disrupted the operations for about 129 days followed by Oracle, Microsoft dynamics and infor with about 122 days, 122 days and 121 days respectively. Due to the happening of disruption, the panorama consultancy came with a solution of phased implementation of ERP system rather than a big bang approach which makes the disruption lengthier.

For the purpose of analysis Panorama (2020) classified significant global ERP vendors into three tiers which is given in the table 3.2. De (2009) in the study explained that the tier wise classification of ERP system is based on the company size of the vendor's client, the number of remote business units and sometimes on the basis of the vendor's client annual revenue. In the study De (2009) also highlighted that there is no exact basis for the tire wise classification of the ERP vendors, it varies from source to source, as well as, the most obvious and practical method to differentiate between different software vendor tiers is by the type of firm they serve

- Tier 1 vendors cater huge multinational corporations
- Tier 2 vendors mostly cater mid-market businesses
- Tier 3 vendors cater smaller than medium businesses

Table 3.2

ERP Vendors

Tier I	Tier II	Tier III		
SAP	Deacom, Inc.	Abel	Solution Integrator & Engineers	Global Shop Solutions
Oracle	DELMIAworks	Ability 585	TECSYS	Henning Software
Infor	Deltek	AddonSoftware	TOTVS	Horizons International
Microsoft Dynamics	Epicor	ADEXA	Trek Global	Include Software
	Exact Macola	American Software	Tribute	Insight Direct
	FUJITSU GLOVIA	Appian	Tyler Technologies	JDA Software Group
	HansaWorld	Apprise	VAI	Jeeves Information Systems

Tier I	Tier II	Tier III		
	Abas ERP	Aquilon Software	Valgen	Jesta I.S.
	Aptean	Ascentis	Verticent	JOBSCOPE
	Batch Master	Blue Link	XTuple	Just Food ERP
	Cetec ERP	Bluebee	Knovalent	Kinaxis
	HarrisData	Boomi	Laserbeam Software	CA Technologies
	IBS	Business Computer Resources	MIE Solutions	Knowledge Matrix
	IFS AB	Carillon ERP	Cezanne	Manex ERP
	NetSuite Inc	CGI	Omega Cube Technologies	Metasystems
	nQativ	CGS	Open Systems	Minotaur Software
	Odoo	Cincom	Cove Systems	NDS Systems
	OMS	Datatex	Enhanced Systems & Service	Openbravo
	Plex	DDI System	ERPNext	Pentagon 2000SQL
	Priority	Edible Software	eSoftware Professionals	Personnel Data Systems
	ProcessPro	Flexi	Exactus Software	Proalpha
	Pronto Software	Friedman Corporation	Expandable	Profitkey
	QAD	Frontier Software	EZWare Technologies	QXpress
	Ramco	Shoptech Software	GCS A2000 Software	Real Green Systems

Tier I	Tier II	Tier III		
	Reflex Enterprise Solutions	Softrader	Serenic Software	SERADEX
	Sage	Software 21		
	SYSPRO			
	TGI			
	VISIBILITY 2018			
	WorkWise ERP software			

Source: Panorama. (2020). *Panorama Consulting Group*. Retrieved from Panorama Consulting: https://www.panorama-consulting.com/resource-center/erp-database/

3.5.1 Popular ERP vendors

There are hundreds of choices of ERP systems available in the software market. According to Panorama (2021) SAP, Oracle, Microsoft Dynamics, Infor, Oracle Netsuite, IFS, Syspro, Rootstock, Acumatica and Delmia Works are the top 10 ERP software vendors, that are efficient in functionality across different industries, including manufacturing, distribution, retail, government, professional services etc.

- **SAP**

It is the System, Applications and Products in Data Processing (SAP AG) the leading providers of business application solutions dealing with client/server. SAP was founded in 1972, in Waldrof, Germany. The SAP systems include SAP Business One, SAP S/4HANA, and SAP Business by Design (Panorama, 2021). SAP S/4HANA offers embedded analytics, robotic process automation and machine learning, whereas SAP Business One is a fully integrated solution for small to midsized businesses. SAP Business by Design is yet another product aimed at small and medium-sized businesses. SAP has been simplifying the complexities of its software and deployments in recent years. They've done so by concentrating on industry-specific models and shifting away from intensive programming in favour of more flexible software. TELCO, Cadbury India, Colgate Palmolive India, Mercedes-Benz India, P&G India, Samsung India, Ranbaxy, Marico Industries, Gasim, Mahindra & Mahindra, ONGC etc. are the SAP implemented companies in India.

- **Oracle**

It's a set of connected apps that gives you a complete picture of your finances and operations. It has blockchain and IoT capabilities that links data from your business operations, customers, machines and products. Oracle offers solutions to a wide range of sectors. Oracle offers solutions to a wide range of sectors. Many data-rich companies use the vendor's services, which include analytics and infrastructure, as well as machine learning and artificial intelligence capabilities. Many of these companies have switched to Oracle's newest cloud services. Oracle ERP financials, Oracle ERP Manufacturing and Oracle ERP Procurement are the three common modules adopted by companies now a days. Sony India Pvt Ltd, Wipro Ltd, Sony India Pvt Ltd, Wipro Ltd, L&T-ECC etc., are some of the companies which implemented Oracle.

- **Microsoft Dynamics**

Microsoft Dynamics is a cloud-based ERP system which focuses on the industries like manufacturing, services including financial services, retail industry and public sector undertakings. It offers services to all the industrial sectors i.e., large, medium and small-scale sectors working in different currency, different languages etc. Microsoft Dynamics 365, the recent innovations in Microsoft Dynamics, which focuses on the SaaS Suits. Microsoft's Dynamics 365 is a cloud-based enterprise resource planning (ERP) and customer relationship management (CRM) combined service that is becoming increasingly popular among modern businesses in India. These businesses operate in the retail, e-commerce, BFSI, and manufacturing industries (Microsoft, 2016). Organizations from numerous industry sectors are currently using Dynamics CRM. These include the Cloudnine Group of Hospitals, Max Healthcare, Yes Bank, Reliance Life Insurance Company, SOTC, VLCC, and many others (Microsoft, 2016).

3.6 ERP implementation Approaches

The ERP deployment approaches can broadly classify into three approaches (Parthasarathy, 2007)

1. Big Bang Approach
2. Location-Wise Approach
3. Module-Wise Approach

Caldwell (2020) presented the implementation approaches in four categories.

1. Big Bang Approach

The 'Big Bang' approach is also known as Single – Step Method (Caldwell, 2020). In this approach the entire end users of the ERP system will enter into the new system together at a single time. This is preferred when a company decides to roll out all important modules in all geographical locations in the entire business units at the same time. This helps the organisation to reap the full benefits of the ERP system. It quickly shows the ERP benefits, like higher productivity and lower operating cost. Even it benefits the organisation a lot, it also carries huge risk. Once the organisation went go live, it is impossible to go back to the legacy system. And sometimes it makes the entire system collapse. As the organisation's legacy system is being replaced by the fully integrated ERP system, the risks are substantial. A few businesses like this method since it allows them to bring an integrated new business process while simultaneously refines their existing system.

2. Phased Rollout

The deployment of features, tools, and components in a phased method takes place over a long period of time, sometimes weeks or months (Caldwell, 2020). This method is less dangerous than a big-bang approach. It also allows the organisation to prioritise "fast wins"—the functions that provide the quickest benefits—and use the lessons learned from the first implementation phases to streamline the process in succeeding phases. But the drawback is that it will take long time to get the cent percent benefits from ERP, not only that, the organisation should carry on both the legacy system and ERP system together. Phased approach can happen in three ways.

- Companies may turn on one ERP module, work out bugs and operational difficulties, and then move on to the next phase. Most businesses begin with their fundamental functions and work their way up from there. Following a review of the existing system, project cost, project length and the exact requirements, the company will pick on any specific module, such as the Finance module, HR module, Materials Management module, and so on, that best suits their needs. Like location wise approach, this approach also has the advantage of analysing the feedback from the new module or modules installed to make future decisions on adopting further modules.
- Another approach is to implement as per business unit, such as finance, HR or logistics, and then progress according to requirements and hierarchies.
- The third strategy is to divide the rollout into phases based on location. Before expanding over to other regional office, zonal office, or head office, factories, or facilities, an organization may test and refine the system at one site in this approach the organisation will be able to lower the project's cost, project’s duration and risk elements, as the new system will replace only part of the organisation. One advantage of this strategy is that the firm receives feedback on the installation of the new ERP system in one of their branches/offices, and on this basis, the company may make future decisions on ERP project expansion.

3. Parallel Adoption

This approach allows the company to continue utilising its legacy systems alongside the new ERP for a fixed period of time. This is considered as the less risky implementation approach as the organisation can switch into legacy system when any contingency or crisis happens. But this is considered as a costly affair as the organisation is required to manage both systems together need more resource and staff time. Data duplication may happen and it makes the errors double. It is the best approach for a company which uses two-tier architecture mainly due to mergers and acquisition (Caldwell, 2020).

4. Hybrid approach

This is the combination of the elements of the above mentioned strategies.

3.7 Modules of ERP

On the inceptive stage, the system was used only for planning and managing the activities in the production department and gradually the system developed to meet the requirements of core business activities such as sales management, production management, accounting and financial affairs, Human Resource Management etc. In recent years it covers almost the whole functions or processes in an organisation. Most commonly the ERP modules handle front-office and back-office tasks like work force management, procurement, inventory management, order management, manufacturing, supply chain management, warehouse management, accounting and finance and CRM (McCue, 2022). HRM, Professional services automation/ service resource management, e-commerce, and marketing automation are advanced ERP solutions that may offer more functionally extensive features.

The present study is focused on the value chain module of ERP proposes by Hitt (2002) from the two-way classification of the ERP module.

The two-way classification of ERP Modules:

Enterprise support modules (human resources, accounting and finance)

Value chain modules (materials management, operations, sales and distribution)

The Present study modified the module code used by Hitt (2002) and coded the modules as under

Level 0 - Purchase of any single module
Level 1 - Core modules: Manufacturing and Finance
Level 2 - Level 1 + Project Management/Human Resource or both
Level 3 - Level 2+ All preceding levels

Below explain some of the significant modules employed by the organisations based of the study conducted by McCue (2022)

- **Finance**

The finance and accounting module supports the business organisation to comprehend the current financial situation and prospects and thereby considered as the most significant ERP module. It produces and maintains important financial records such tax returns, payment receipts, and balance sheets. It tracks Accounts receivables and payables and also maintain managing the ledgers, billing, Cash management systems, on time closing of books, Reconciliation of Accounts, preparation of essential reports, like Profit and Loss account, balance sheet and other key reports. The module also helps to ensure that the accounts are managed and reports are generated by following accounting standards and other prevailing rules.

- **Workforce Management**

The Workforce management module is utilised by those firms which are operated by employees working in hourly basis than salaried staff. It considers the attendance of the workers and working hours of the employees to determine their productivity, idle time, incentives, bonus and also their absenteeism. It helps in measuring the key performance indicators, supports the preparation of payroll, managing the tax rates, employee expenses etc..

- **Human Resources Management**

A human resource management module is an advance version of the Workforce Management Module. It includes both the features of Workforce management module and additional features like measuring the employee turnover, it maintains the records of every employee in the organisation, job specifications, job descriptions, performance appraisal of employees, their performance reviews, achievements, offer letters, job rotation reports, training reports, prospect training programs etc. HRM module helps the HR department to remove duplicate, unnecessary and inappropriate data. The module enhances the human relationship management in the organisation.

- **Procurement/Purchasing Module**

The Module ensures the availability of materials or products on time in required quantity at minimum wastage for manufacturing or for its sales. It maintains the list of vendors, automates the quotation request, tenders, supports purchase order preparation and its proper dispatch and secures the availability by proper tracking of sales order and shipment and proper updation of the inventory level.

- **Manufacturing**

The module aids producers in production planning and ensures they have all the supplies and equipment necessary for scheduled production runs. It assists in the calculation of the average time required to produce a product, which can help to meet the forecasted demand and thereby the organisation can make adequate production. It helps to monitor the Goods in progress and its status updation. The continuous monitoring helps to detect any deviations of actual production from scheduled one. The proper updation of the shop floor activities helps the production department to capture a real and timely picture of work in progress and the status of the finished products.

- **Inventory Management**

The module facilitates inventory control by monitoring the quantity and locations of individual stock keeping units. It tracks the current inventory and the inventories which are upcoming. Inventory cost control is the significant feature of the Inventory Management module of ERP by eliminating the excessive stock and thereby avoiding too much investment in inventory. It helps to accelerate the inventory turnover and profit margin by ensuring the product availability as per the market trend. The tracking of sales trend and product availability helps to enhance the customer satisfaction by avoiding delay in product delivery and stockouts. Sometimes business organisation also uses this module for managing sales order, logistics and purchase order. The organisations which have multiple locations can make use of this module for inventory control in different locations.

➢ Warehouse Management

This module facilitates picking of the product from shipments, packing and shipping. The picking can be done in the proper way as required by the businesses like batch picking and zone picking. It helps to determine the workforce required for the operations. The module helps to enhance customer satisfaction by fast delivery of products by integrating the module with order management and inventory management module.

➢ Order Management

The module manages the order of the customers by accepting the order sending the details of the order to the concern warehouse, distributors or retailers. It also tracks the progress of the respective order until its final delivery to the customers. The module tries to ensure the reduction of futile cost for expedited shipping. It prevents the happening of losing an order and timely delivery of received order and enhance customer satisfaction and customer retention.

➢ Supply Chain Management

The module tracks each stage of the flow of supplies and products from sub-suppliers through suppliers, manufacturers, distributors, retailers, and customers. It also tracks the return and refund and also replacement if any. The module can encompass a wide range of modules, including manufacturing, procurement, warehouse management, inventory management and order management.

➢ Customer Relationship Management (CRM)

It helps to maintain the information of customers and prospects, including frequency of purchase, fashion preference of the customer, communication history, customer queries and complaints. This helps to approach the customer by providing the exact product and service they required while dealing with the customer. This manages sales leads and help to grasp more opportunities. The organisation can customise the product or service by observing the information collected. The module facilitates the market segmentation and supports the target marketing. If there is a well-established CRM module, it will be the core competency of the organisation.

- **Professional Services Automation (PSA)**

Service resource management module is another term used for PSA modules. This facilitates the planning and management of business projects. This module is often used by service-oriented business organisations. The module helps the planning and monitoring of a project, manages the capital and human resources required for the project, manages the cost and helps the preparation of timesheets, manages the coordination of the project team, coordination of the documents required for the project, automates bill preparation and its approval and clearance as per the prevailing terms and conditions.

- **Marketing Automation**

This module is the recent marketing management technology utilising by the organisation to track the marketing campaigns in different digital and social media campaigns like web sites, emails, SMS, Facebook, Instagram, personal messages etc. More customised form of marketing can manage by this module by advance customer segmenting features so that irrelevant messages can avoid. The reports of these campaigns can scrutinise for planning the future marketing programs to enhance customer loyalty and retention.

- **E Commerce**

This module facilitates enterprises in easy launching of e-commerce websites like Business to Consumer (B2C) or Business 2 Business (B2B). The integration of this module with another ERP module helps to feed the data from this module to the shared database and thereby ensures the settlement time of an order.

3.8 ERP Market

The section provides an insight to the ERP market both national and international.

3.8.1 Global ERP market

Market Statsville Group (MSG), one among the leading market research, business advisory and strategy builder made an attempt to study about the ERP software industry outlook and identified that the global ERP software market size was valued at USD 38.12 billion in 2020 and is expected to grow at a CAGR of 12.7 percent over the forecast period, reaching USD 84.41 billion by 2027 (Marketstatsville, 2020). This growth rate is anticipated due to the growing demand of the cloud-based ERP software. The market research of Marketstatsville (2020) finds that, due to the quarantines and business closures imposed by the COVID-19 pandemic, the market witnessed a significant drop in sales and profitability of business. The existence of the pandemic has had a favourable impact on the ERP Software market, as a result of the imposed lockdown and shutdown facility regulations, which has resulted in an increased online platform. Hence, this centralized data system of ERP software made the situation easier to handle which leads to the enhancement of global ERP software market. Marketstatsville, (2020) estimated that North America will dominate the global ERP software market with the majority of market share, followed by Asia Pacific. Initially, ERP system was targeted only at the manufacturing enterprises, especially those working in large scale. But in recent years it has been used in diverse industries not only in the medium scale industries but also emphasized on the small and micro enterprises. The leading ERP software vendors at the global level are SAP, Oracle Corporation, Microsoft Corporation, Infor, IFS, Sage Software Solution Pvt. Ltd., Epicor Software Corporation, SYSPRO, Workday, Inc., Deskera, Infor, Intacct Corporation, and Plex System Inc.

The last half of the 21st century has been heralded ‘The ERP Era’ ‘The Enterprise Resource Planning revolution ‘with enterprise systems implemented in most Fortune 500 companies (Vaman, 2007).

3.8.2 Indian Manufacturing Sector and Indian ERP market

This section gives an overview on the Indian manufacturing sector and ERP implementation in the manufacturing sector in India.

Liberalisation policies of govt., the influence of FDI, growing demand of the consumers, the dynamic changes in the consumer behaviour etc. has shown a path for a rapid growth in the manufacturing sectors. But Indian manufacturing units failed in utilising the benefits. India's manufacturing-sector GDP increased by an average of 9.5 percent per year from fiscal year 2006 to fiscal year 2012 and then growth slowed to 7.4% in the following six years (Dhawan & Sengupta, 2020). Manufacturing sector contributed 17.4 percent of India's GDP in fiscal year 2020, up from 15.3 percent in fiscal year 2000. Furthermore, the manufacturing sector's share of employment in India has expanded by only one percentage point during the past 13 years, compared to a five-point gain in the services sector.

The diffusion of ERP systems in large and small-medium-sized organisations (SME) has been, by far, the most significant movement in the information technology sector since the 1990s (Upadhyay et al., 2010). It has been realised by the large and medium scale manufacturing enterprises that the integration of business activities is very crucial for improving productivity, efficiency, and overall business performance, which may be accomplished through the installation of ERP software package and many ERP vendors have been trying hardly to overcome the economic, cultural, and fundamental infrastructure barriers that developing economies face (Dalal et al., 2004).

Based on several modules ERP has revolutionised the way businesses are conducted in India, and more and more organisations and industries are now embracing this system. The usage of software tools such as ERP, which encompasses human resource planning, management control, and operational control, has significantly enhanced the performance of many Indian organisations. Many people today believe that ERP has a lot of potential in the manufacturing industry.

ERP systems are still in their infancy in developing nations like India. In comparison to developed countries, factors such as a lack of capital, a lack of resources, a poor management base, and a lack of IT expertise have been found to have a significant impact on the implementation and adaptation of enterprise systems in India and other similar Asian developing countries (Upadhyay et al., 2011). The

the situation is changing now. Like every developing country, India is also a late adopter of ERP system. Post liberalisation era changed the perception of ERP implementation, it became a necessity rather than an option covering the entire operations of the organisation. Some of the early adopters of ERP system in India are HLL, ONGC, Godrej Soaps, Cadburys, ESSAR, BASF, Telco, Century Rayon, Citibank, Maruti Udyog Ltd, ACC, ANZ, German Remedies, Blue star, Grindlays, Mahindra & Mahindra, Rallis India, Ceat Ltd, Indal, Sony India Pvt Ltd, Ford Motors, Kirloskar, Glaxo, Knoll Pharmaceuticals etc., (Goyal, 2011).

As per the report of Research and Markets 2019 (the world's largest market research store) Indian manufacturing ERP market was worth US$ 262.7 billion in 2018 and is predicted to increase at a CAGR of 11.9 percent from 2019 to 2027, reaching US$ 712.7 billion in 2027. The favourable growth outlook for implementing severe regulatory compliances and the growing demand for their adherence is likely to drive the India manufacturing ERP market during the forecast period of 2019 to 2027. However, the hurdles associated with high upfront costs associated with adoption and upgradation may limit the India manufacturing ERP market's future growth. Despite these drawbacks, higher degree of interaction with other systems is expected to provide abundant chances for growth for participants in the India manufacturing ERP market throughout the forecast period.

The India manufacturing ERP market is divided into pharmaceuticals, automotive, consumer electronics, metallurgy energy, chemicals, retail & apparel, food & beverage, and others, based on end-user industry. Food & Beverage accounted for a significant portion of the India manufacturing ERP market in 2018 (The Research and Markets 2019). As per their report CBO Infotech Pvt. Ltd., CRIMS (Unicode Solutions), SAP SE, Gamut Infosystems Ltd., Teknovative Solution, Netsoft Solutions India Private Limited, Oracle Corporation, Epicor Software Corporation, Oracle Corporation, Infor Inc and The Sage Group plc are some of the notable ERP vendors in the Indian ERP market.

3.9 Cost of ERP Implementation

ERP costs should not be considered as an expense, but rather as an investment that provides opportunity to improve profitability, market share, and customer service via integration and automation (Altekar, 2005). ERP implementation cost is not just the system cost, but it also includes ownership cost and both make the implementation of ERP system a costlier affair. Hence, it is very significant to set an ERP implementation budget a realistic one, otherwise the unrealistic expectation of cost makes the system implementation a failure. The cost of ERP implementation consists of both the cost of the software along with some common project cost. Peatfield (2021) explains some important or tangible components in the cost of ERP, which includes

- Software licensing fees
- Customization and configuration if necessary
- Additional servers and network hardware
- Data conversion and transfer to new ERP
- Testing
- Training
- Vendor/consultancy support post implementation

Hutchison (2015) opines that the software cost depends on the number of users, industry and its complexity and number of locations and the estimated percentage allocation of cost of ERP implementation can be classified as:

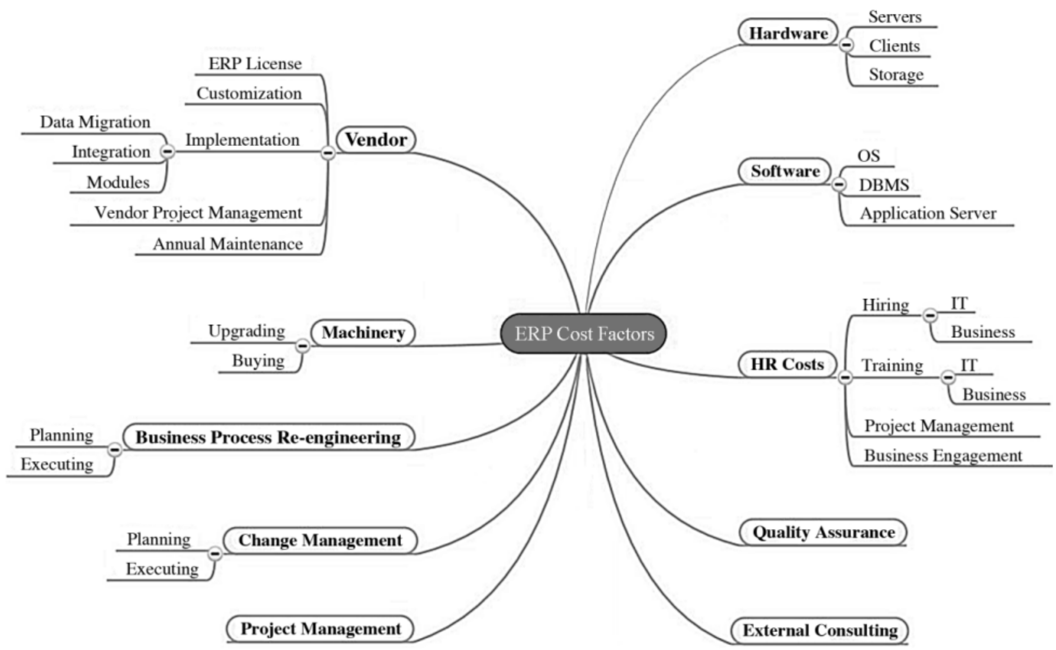
- 5% to 10% for database management
- 10% to 20 % infrastructure cost: It is the cost incurred for acquiring hardware to run the ERP system effectively.
- 15 to 30 % software license cost
- 40% to 60 % is for human resources. This Majority of the ERP implementation cost depends on the human resources involved in the ERP implementation project. It includes Consultant cost, training cost, additional wages etc. Some

key users or users which are excellent in ERP may require to spend most of their working hours on the new ERP system. The organisation is required to appoint additional staff to replace those key employees or users.

Haddara and Elragal (2013) presented the bifurcation of the cost of an ERP implementation project into vendor cost, hardware cost, Software cost, Machinery cost, HR costs, BPR, change management, project management, quality assurance and external consulting. The classification is given in the figure 3.3

Figure 3.3

ERP Cost Factors List



Source: Haddara, M., & Elragal, A. (2013). ERP adoption cost factors identification and classification: a study in SMEs. *International Journal of Information Systems and Project Management*, 5-21.

The basis for the classification of the cost of ERP implementation developed by Hutchison (2015) are:

- Vendor cost is based on the implementation method, project size, experience, product performance and licensing.

- BPR depends on the business nature, nature of ERP vendor (national or international ERP vendor), nature of implementation (international or local), ERP scope/generic.
- External consultants cost depends on Scope of acts, the complexity of business, type of business; experience of the consultant.
- The Hardware cost is based on the decision regarding the lease or buy and the requirements of the business.
- Software cost depends on licensed/proprietary Vs. open source.
- Cost of HR and project management depends on business engagement.
- The cost of change management is based on the size of the company.
- The cost of quality assurance is based on business engagement.
- The cost of logistics depends on the size of the business, inlets/outlets and distance of the facilities.
- Machinery and services depend on the type of business and scope.

3.10 Issues and Challenges in ERP Implementation

Considering ERP as the utmost solutions to every issue with the organization makes the system a big failure. No companies can completely rely on the ERP system. There are lots of challenges and issues in the adoption of ERP. Atkinson (2013) listed some of them as follows

- Budget overruns
- Time overrun and poor progress
- Searching short cuts to mitigate the issues of time overrun
- Lack of resources and expertise
- Confusions and conflict within the organization
- Frustrated Management

- No perceived benefits to forward
- Unrealistic issues of implementation instructions
- Misrepresentation of experience and expertise by ERP software vendors and their partners.
- Assigning of inexperienced people to manage the ERP project by the vendor
- Providing training by inexperienced trainers, who are not efficient even to provide the basic questions regarding ERP software
- The claims of a tried-and-true approach and best-practice implementation procedures were sales gimmicks.
- The software house hid or deceived the company about the ERP software's functionality restrictions.
- Instead of deploying the system within the specified time scale and budget, the software house and its implementation partners are more interested in gouging the company for more bucks at every chance.
- The trainers' linguistic comprehension issues
- Lack of involvement and commitment of top management
- Failure in analysing the initial requirements and lack of ERP knowledge of the organization
- Underestimation of budget for training, education, data cleanup, Data migration, hardware cost, BPR cost etc..
- Lack of mobilization of resources
- Scope Creep
- Inefficient change management process
- Preparation of unrealistic EPR implementation project schedule
- Differences in the expected unrealistic software expectations and reality
- Unrealistic benefit expectations and ROI

- The normal day to day business operation pressures and high cost hinder the training and educational programs and workshops
- Unrealistic time estimation of Go Live

3.11 Research models for ERP

The present study is to elicit the process adopted by different manufacturing organisations in implementing the ERP system and the outcome of these implementations. The study is based on the (a) Process theory proposed by Mohr (1982) and then later developed by Soh & Markus (1995), (b) Stages theory by Nolan (1973) (c) The De Lone and McLean Model of Information Systems Success by Delone & Mclean (2003) and (d) Value Triangle by Morrison (2017) which illustrated the IT acquisition process, its deployment methods, the real impact from the project implementation in the immediate years of implementation and the outcome in the following years after improvisation and updation if any.

3.11.1. Process Theory

Soh and Markus (1995) refined the process theory developed by Mohr (1982). Soh and Markus (1995) tried to answer the question about the failure of reaching the expected outcome which is absent in the process theory developed by Mohr (1982). Soh and Markus (1995) developed a complete IT process model that leads to creation of business value. The study explained the probabilistic processes, necessary conditions and the outcome of IT investment which is presented in the table 3.3.

Table 3.3

Process Theory

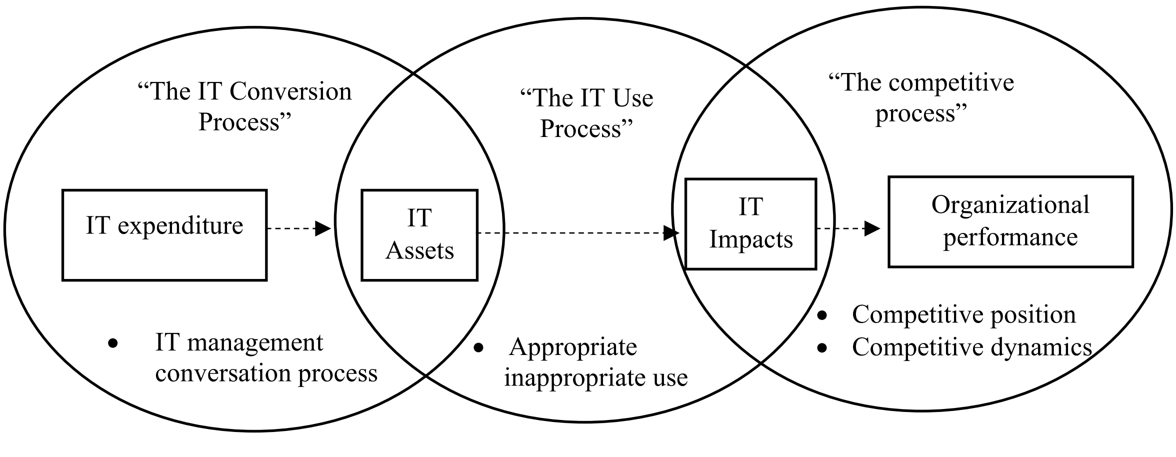
Process Theory and Focal Unit	Outcome	Necessary Conditions	Probabilistic Process	Recipe for outcomes
IT assets; Focal unit is the 1T acquisition or deployment project/process	IT assets: (1) useful, well-designed applications (2) flexible IT infrastructure with good "reach" and "range" (3) high levels of user IT knowledge and skill	IT expenditures	Process losses" or conversion ineffectiveness - due to poor IT management policies or to inconsistent application of good policies; stakeholder politics; including external vendors	IT assets occur when 1T expenditures are converted efficiently and effectively, a process influenced by policies and politics
IT impacts; Focal unit is the organization or some subset (business unit, functional area, business process)	Organizational impact due to IT investment: (1) new products/services (2) redesigned business processes (3) better decision-making (4) improved coordination flexibility	IT assets	Individual discretion in complying with organizational directives, including those pertaining to IT adoption and use	Impacts occur when people and organizational units use IT assets (technology and skills) appropriately, a process affected by organizational structures, processes and culture
Enhanced organizational effectiveness; Focal unit is the organization in its industry or environment	Improved organizational performance due to 1T investment: (1) financial (2) stakeholder value (3) productivity	Organizational impacts due to IT investment	Competitive dynamics; Competitor and customer reactions	Outcome occurs when organizational impacts due to IT investment combine with favourable economic and environmental conditions

Source: Soh, C., & Markus, M. L. (1995). *How IT Creates Business Value: A Process Theory Synthesis.* Retrieved from AIS e Library: https://aisel.aisnet.org/icis1995/4

The above table adapted from Mohr (1982) by Soh and Markus (1995) for explaining the probabilistic process. The researchers developed the necessary conditions and probabilistic process of IT implementation in a sequence. Firstly it explained about the organisation's expenditure on IT, subject to varying degree of effectiveness during the IT management process to obtain the IT assets. Secondly, to obtain the quality asset by acquiring favourable IT impacts by combining the process of appropriate IT use; and finally, to acquire better organisational performance by favourable IT impacts without any adverse effect in the competitive process. Thus, Soh and Markus formulated the relationship between IT investments and business value by identifying solutions to how, when and why IT creates value which is illustrated in the process theory model, which is given in the figure 3.4

Figure 3.4

Process Theory Model



Source: Soh, C., & Markus, M. L. (1995). *How IT Creates Business Value: A Process Theory Synthesis.* Retrieved from AIS e Library: https://aisel.aisnet.org/icis1995/4

The model developed by Soh & Markus was a widespread accepted model which explained the relationship between IT expenditure and IT asset and IT impact and finally IT impact and organisational performance. The present study is based on the process theory model developed by Soh and Markus (1995) and focusing on the necessary conditions developed i.e., ERP expenditure, ERP assets, ERP impact and organisational performance

3.11.2. Stages theory

Nolan, (1973) proposed the stage theory in 1973, when the use of computer technology was in its early stage. The stage theory developed in different stages in the implementation of computer resources focusing on the budget. The theory also helps to identify the benefit acquiring stages and explains organizational learning for acquiring those benefits till its retirement through effective IT management. The significant objective of Nolan's stage theory was to lessen the functional cost. In the first stage as per stage theory, the organisation automates its well-known operations that fall under the umbrella of Transaction Processing Systems (TPS) with the basic IT knowledge and doesn't require much specialisations (Bansal, 2013). In the second stage, the management keeps pumping money into the business in the hopes of seeing improved outcomes. Employees become more innovative in this laid-back setting. People from several functional domains are also becomes the users of information systems. The following level is the control stage, where the managers' goal is to increase ROI and they also rely on IT to make decisions. At the final stage, the management begins integrating IT applications and creating a database that will serve as the backbone for all applications. Because the manager approaches these investments like any other, a cost-benefit analysis of IT has been performed at this stage. Each stage, according to Bansal (2013) may last six to seven years.

The study used the stage theory for understanding the time, when the benefits of the ERP investment will reflect on the firm's performance. Thus, from the final analysis of the dataset used for this study, it can conclude the stage of ERP implementation impact.

3.11.3 The De Lone and McLean Model of Information Systems Success

Delone and Mclean (1992) builds a richer model for measuring the IS success from the theoretical foundation provided by the process and ecological principles from the organisational effectiveness literature. The developed model recognises success as a process construct that must take both temporal and casual factors into account when determining IS success. These success measures are categorised into six by Delone & Mclean, which are:

i. System Quality, which can be measured by the data accuracy, data currency, database contents, ease of use, ease of learning, convenience of access, human factors, realisation of user requirements, usefulness of system features and functions, system accuracy, system flexibility, system reliability, system sophistication, integration of systems, system efficiency, resource utilisation, response time and turnaround time.

ii. Information Quality can be examined by checking the importance of information, relevance, usefulness, informativeness, usability, understandability, readability, clarity, format, appearance, content, accuracy, precision, conciseness, sufficiency, completeness, reliability, currency, timeliness, uniqueness, comparability, quantitativeness and freedom from bias.

iii. Information use can look over with the amount or duration of use, number of inquiries, amount of connect time, number of functions used, number of records accessed, frequency of access, frequency of report request, number of reports generated, charges for system use, regularity of use, use by whom? binary use, nature of use, level of use, recurring use, institutionalisation of use, report acceptance, voluntariness of use and motivation to use.

iv. User satisfaction, which can be measured by scrutinising the satisfaction with specifics, overall satisfaction, single-item measure, multi-item measure, information satisfaction, enjoyment, software satisfaction and decision-making satisfaction.

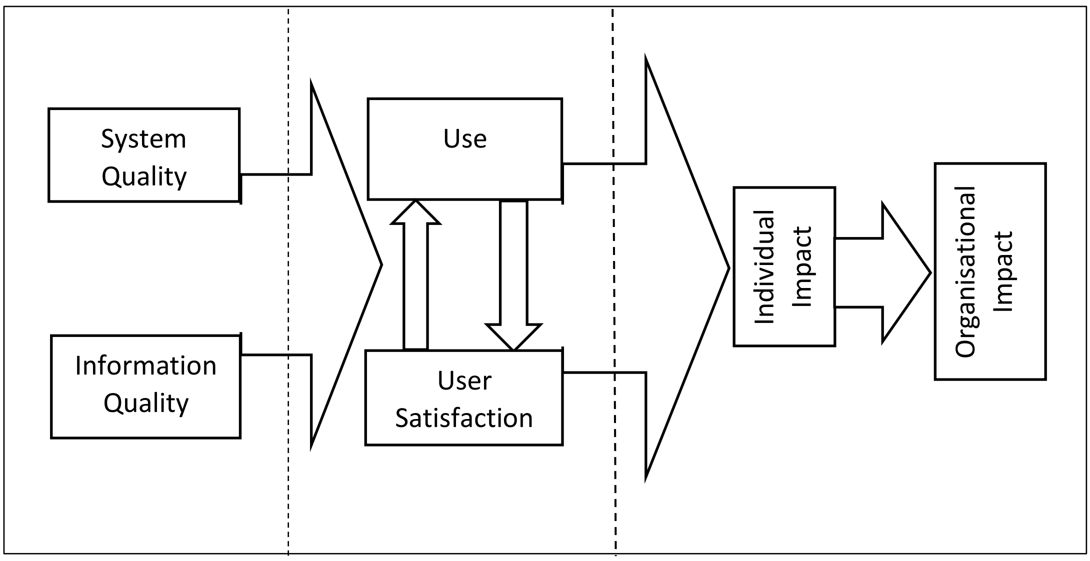
v. Individual Impact can be measured by studying the information understanding, learning, accurate interpretation, information awareness, information recall, problem identification, decision effectiveness, improved individual productivity, change in decision, task performance, quality of plans, individual power or influences, personal valuation of IS and willingness to pay for the information

vi. Organisation impact can be measured by checking the application portfolio, operating cost reduction, staff reduction, overall productivity gains, increased revenues, increased sales, increased market share, increased profits, return on investment, return on assets, ratio of net income to operating expenses, cost/benefit ratio, stock price, increased work volume and service effectiveness

As per Delone and Mclean (2003) the D&M IS success model's System Quality measures the technical success, the semantic success are measured by Information quality and the remaining four components i.e., Use, User Satisfaction, Individual Impacts and Organisational impacts together measure the effectiveness success. The organisations can develop a clear framework of the information system success with the six-component developed by Delone and Mclean, in which the six of them are not independent from one another but they are interrelated to each other which is presented in the figure 3.5.

Figure.3.5

IS success model

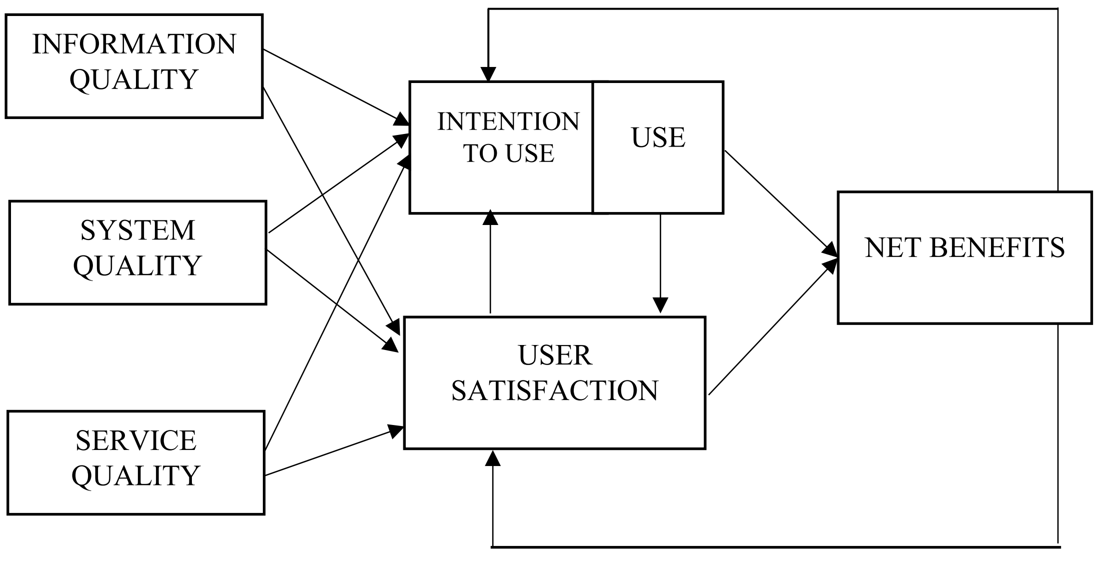


Source: Delone, W., & Mclean, E., (1992). Information System Success: The Quest for the Dependent Variable. *Journal of Management Information Systems*, 60-95.

As the role of IS is changing drastically and the D&M IS success model became popular, Delone and Mclean further worked on the six component IS success model and refined and updated the D&M IS success model in 2003 and 2004. They added service quality to information quality and system quality; and also permitted the adopters of this theory to use either the term use, which is described as an attitude or can use the word intention to use, which is a behaviour. Delone & Mclean also combined the term individual impact and organisational impact into net benefits so as to avoid the confusions regarding positive impact or negative impact and net is used for getting more accurate final success variable. The updated D&M IS success model is shown in the figure 3.6, Delone & Mclean used the D&M IS success model in identifying and specifying the e-commerce success metrics

Figure 3.6

D & M IS Success Model



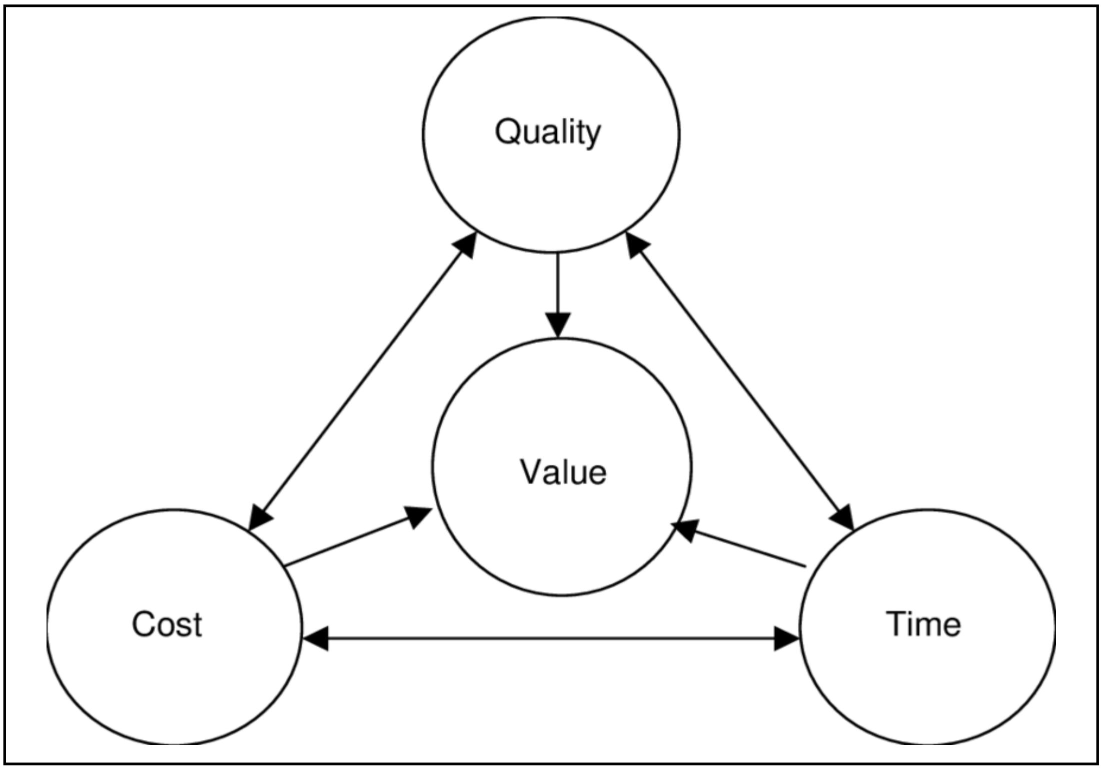
Source: Delone, W. H., & Mclean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 9-30.

3.11.4 The value triangle

The value triangle is also known as the Project Management Triangle, Triple Constraint and Iron Triangle. Martin Barnes created the triangle of objectives in 1980s. The triangle is formulated to present that the quality, time and cost of a project are interrelated to create the value of the project. Any variation in any of the angle may change the value of the project. So, the study recommended to fix any triangle fixed and to alter the other. Many organisations they will make a trade-off between cost or quality to make the project finished on time. The below figure 3.7 is the value triangle proposed by Barnes (1988). The value triangle identifies three characteristics that relate to client satisfaction with the outcome of a construction project (Saha & Hardie, 2012). These are the final project cost in relation to the budget, project delivery timeliness, and the quality of the project outcome.

Figure 3.7

The Value Triangle

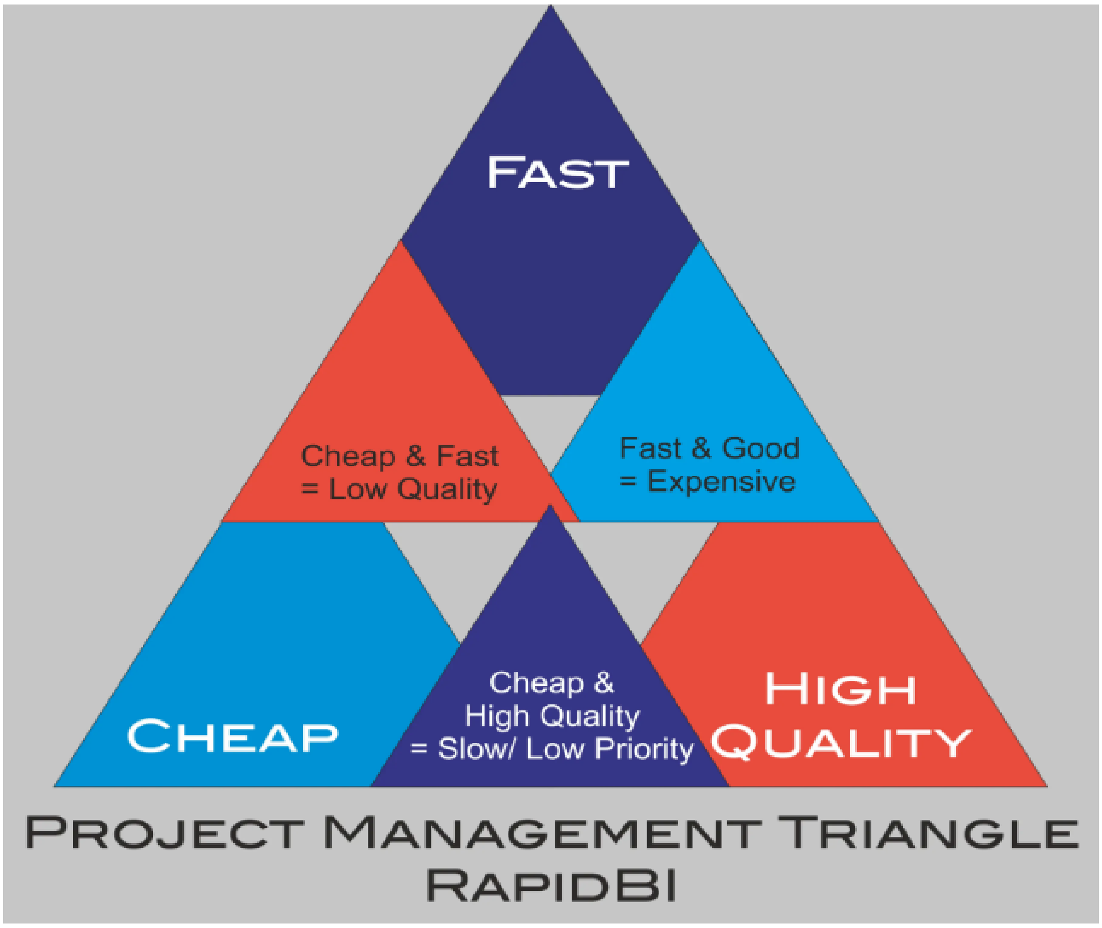


Source: Barnes, M. (1988). Construction project management. International Journal of Project Management, 69-79) & Saha, S., & Hardie, M. P. (2012). Builders' Perceptions of Lowest Cost Procurement and Its Impact on Quality. Australasian Journal of Construction Economics and Building, 1-8.)

Morrison, (2017) explained a combination of these factors as, if the organisation opts for a fast and cheap way for completing the project but it affects the quality. If opt for a cheap project with good quality, it won't be on time and if opt for a project with on time completion and having good quality it won't be cheap. The optimum varies from one organisation to another. The figure 3.8 developed by Morrison (2017) is showing the interconnection between the three constructs of a project.

Figure 3.8

Project Management Triangle



Source: Morrison, M. (2017, March 23). The Project Management Triangle – Time, Quality, Cost – you can have any two. Retrieved from RapidBi: Knowledge, Understanding and Action: https://rapidbi.com/time-quality-cost-you-can-have-any-two/

3.12. Summary

This part of the study introducing the ERP, how it evolved from MRP to present ERP II or E^2RP and a brief information on Indian and Global ERP were explained. Many ERP vendors are providing ERP software and the organisations are implementing those modules which satisfies their requirements through different ways, through big bang approach, module wise, phased etc. in Indian large and medium manufacturing sector. The process theory of Soh & Markus (1995), the Stages theory of Nolan (1973) and DeLone and McLean Model (1992) of Information Systems Success, Project management triangle of Morrison (2017) are used as the theoretical base of the study.

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Chapter Four

ERP IMPLEMENTATION PROCESS AND THE CSFs

4.1 Introduction

Like every other major business decision, the implementation of ERP entails an in-depth study and analysis before taking a big leap. First of all, the decision makers want to find answers to many questions. The first question is whether it benefits the business or not, then comes another, the 'why' question and then 'what', then 'where, when, who and how. From the point of view of ERP implementation, the questions and their answers are like;

'**Why ERP'**: the need of ERP, comparison of ERP with other available packages, the benefit of ERP to the organization.

'**What**': what package to adopt, which modules to select, what functions to cover.

'Where': evaluation and selection of ERP vendor, decision regarding adoption of ERP consultant, Consultant's evaluation and selection.

'When': the time period of starting the implementation and go live.

'Who': planning a project team, their composition and project team number.

'How': preparing the organization and its information technology, transferring data from legal to ERP, running trials and testing.

These are the major questions faced by the organization in the different phases of ERP implementation and answers to these questions are very critical for the successful ERP implementation. The answers to these questions will take months and years of analysis, to take decisions.

ERP implementation can happen only through different stages (Desai and Srivastava, 2013). These stages taken together form the process of ERP implementation or Life cycle of ERP implementation. ERP implementation is considered as a major project as it involves large investment and a long-life cycle.

Many academicians, scholars and business people made investigations and did analysis on the process of implementing an ERP system. Hence, there are studies available, that describe the process of ERP implementation and the critical factors associated with each stage.

The purpose of this chapter is to make a detailed study of the available literatures to identify the most relevant steps in the process of ERP implementation and the CSFs in each phase. The identified CSFs are then scrutinised to ascertain their impact on the performance of the organization in further chapters.

This chapter is categorized into three different parts

1. Identifying the different phases and the process involved in the identified phases of ERP implementation. Along with the identification of the ERP implementation process, the study tried to find out the CSFs involved in the implementation process.

2. Next part of the chapter focuses on listing the identified process and the CSFs from the available literatures.

3. From the list developed in the second stage, the study proposes the inevitable process and phases in the ERP roll out and the significant CSFs associated with these stages.

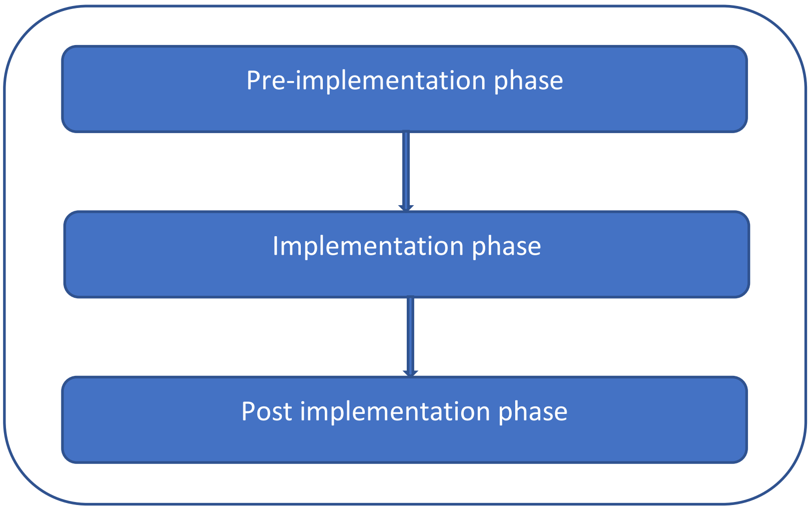
The study analysed and identified the impact of these CSFs on the capability of the organization and its financial performance in the following chapters.

4.2 ERP implementation process and CSFs

The process or life cycle of ERP implementation given in the Figure 4.1 can broadly classified into three distinct stages The pre-implementation phase, implementation phase and the post-implementation phase by Motwani et al., (2005).

Figure 4.1

Phases of ERP implementation

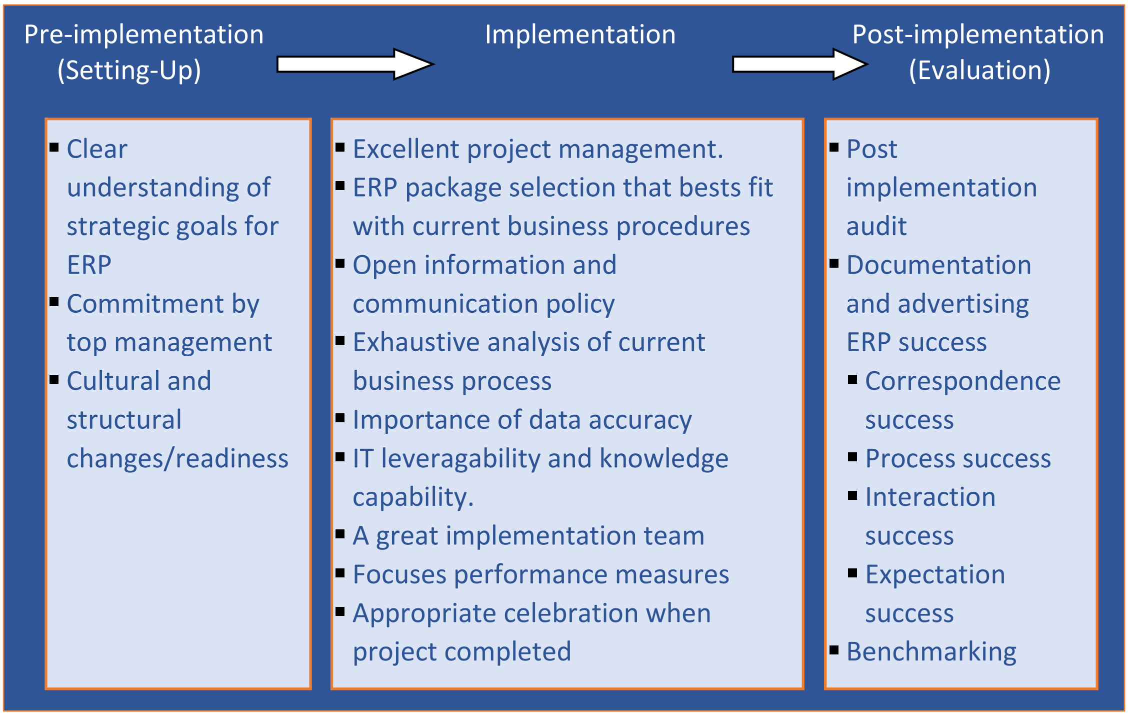


Sources: *Motwani, J., Subramanian, R., and Gopalakrishna, P. (2005). Critical factors for successful ERP implementation: Exploratory findings from four case studies. Computers in Industry, 529-544*

Motwani et al., (2005) detail the different activities included in the pre-implementation, implementation and post implementation phases of ERP which is shown in Figure 4.2.

Figure 4.2

ERP implementation framework

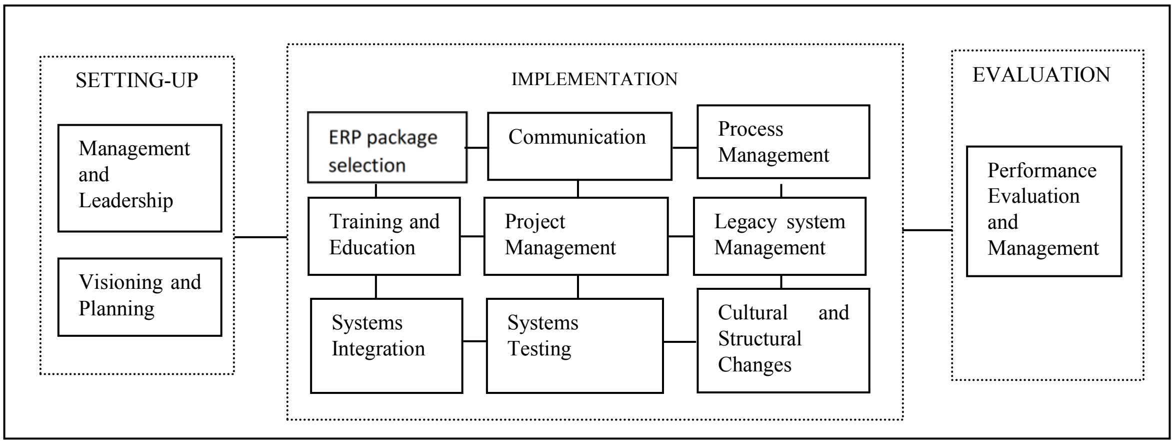


Source: *Motwani, J., Subramanian, R., and Gopalakrishna, P. (2005). Critical factors for successful ERP implementation: Exploratory findings from four case studies. Computers in Industry, 529-544.*

Generally, the phases of ERP implementation can be classified into three stages as expalined before ie., the pre-implementation, implementation and post-implementation phases. Al- Mashari et al. (2003) classified these three phases in another way to identify the CSFs corresponds to each phase. The ERP lifecycle phases claasified by Al- Mashari et al., (2003) are shown in the below Figure 4.3

Figure 4.3

Taxonomy for ERP critical factors

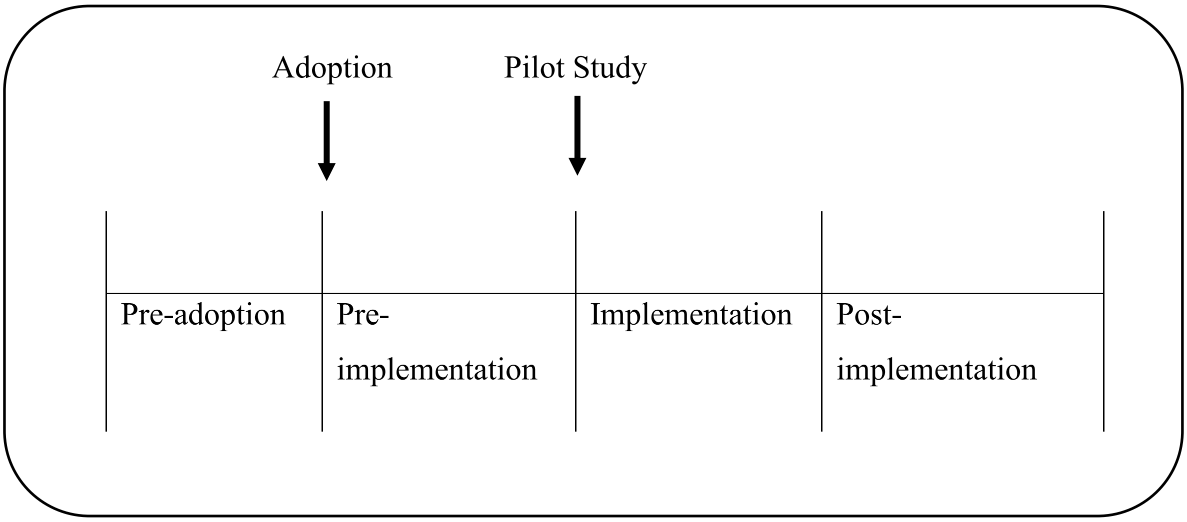


Source: *Al-Mashari, M., Al-Mudimigh, A., and Zairi, M. (2003). Enterprise Resource Planning: A Taxonomy of Critical Factors. European Journal of Operational Research, 352-364*

Beyond the basic three phases of ERP implementation by Herold et al., (1995) added one more phase i.e., the pre-adoption phase. **Pre-adoption** is the stage in which organisations begin to examine the need for technological change, scan the environment for technology options, consider or reconsider strategic directions, and initiate activities that will eventually lead to an *adoption* decision. The **pre-implementation** activities like planning for technology introduction, deciding on the role of the vendor and in-house resources in managing the technology introduction, providing preliminary training, planning the logistics of the change, deciding whether to use a pilot study and whether everything will be changed at once, or whether to use a gradual phase-in would begin at the point of adoption. If there is a pilot research at this point, it will be at another stage. The actual **implementation**, or shift from the old to the new, comes next. This stage of the process may vary in length, and its borders are frequently ambiguous, i.e., when does it end? Some implementations may necessitate lengthy periods of adjustment, and even then, they may be dropped. **Post-implementation** is often described as routinisation, or "return to a steady state" The phases developed by Herold et al., (1995) are presented in the Figure 4.4

Figure 4.4

Technology adoption and implementation timeline



Source: *Herold, D. M., Farmer, S. M., and Mobley, M. I. (1995). Pre-implementation attitudes toward the introduction of robots in a unionized environment. Journal of Engineering and Technology Management, 155-173.*

Predominantly, the phases of ERP implementation were classified into three stages i.e., the pre-implementation, the implementation and the post implementation stage. But many literatures classified the phases in other way like classification of Parthasarathy (2007), Sun et al., (2015) and Ross (1999). But while delving into those literatures, their classification can be also categorised into these three stages.

The different phases of ERP implementation and the CSFs identified by Parthasarathy (2007) are given in the Table: 4.1

Table 4.1

Phases of ERP implementation

Project Planning	o Parties involved: Top Management o CSFs: Project duration, Project budget, Deployment team from the organisation, Technical and functional consultants, ERP vendors, ERP packages, training and change management
Identification of ERP Vendor	CSFs: Reliability of the vendor, Ability to meet customer's requirement, Functionality of the ERP package, Vendor's reputation, Vendor's ability to provide a complete solution, Project costs, Future software maintenance provided by the ERP vendor, Ability to handle customisation, project duration and training facilities
Evaluation of ERP Package	o Parties involved: Top Management and ERP project team CSF: Proper ERP product or package evaluation will lead to the selection of the best ERP package, which will aid in the completion of the remaining phases of ERP deployment.
Gap Analysis	CSFs: The organisation seeks to identify the gaps between its current operations and those provided by the ERP software. Gap analysis solutions exists in different forms, including discovering a third-party product that could fill the gap, designing a custom program, and modifying the ERP source code.
Reengineering	Parties involved: High level executive CSFs: The organization's existing business process will be modified, a new process can be added and current processes can be eliminated after a thorough examination of the present system.
Customisation	CSFs: End user's requirements, technical requirements, vision of top management o Higher customisation will prevent the company benefiting from the integrated software features such as refining the existing business processes, standardise the existing system and enhancing the overall performance of the organisation.

ERP Team Training	To get the most out of the software, we need to get people in our firm to adopt the software's work methods outlined.
Testing the Product	The product will be put to the test to ensure its consistency, integrity, validation and verification of an organisation's requirements, reliability, etc.
Going Live and Training for End Users	The product will be delivered and after the go-live date has been determined, the end-users will receive the necessary training.
Maintenance	When the product starts functioning, the organization's maintenance activities will begin simultaneously.

Source: *Parthasarathy, S. (2007). Enterprise Resource Planning (ERP) - A Managerial and Technical Perspective. New Delhi: New Age International (P) Limited.*

The five-stage ERP deployment model identified by Sun et al., (2015) is widely accepted in the literature, particularly by models that include five stages of ERP deployment. The five stages and the factors which are critical for the successful ERP deployment are given below

- **ERP Organisation Readiness**: This stage entails a *readiness assessment* of the focal enterprise in terms of resources and management before selecting a candidate ERP solution. This stage also enables the company to address any *performance gaps discovered* in order to meet ERP deployment criteria.

- **ERP Selection**: At this stage, an in-depth evaluation procedure is carried out for *selecting an appropriate ERP package and implementation partners*, followed by *a negotiating process* in which contractual conditions are worked out, and finally, the board of directors makes and confirms a *final recommendation*.

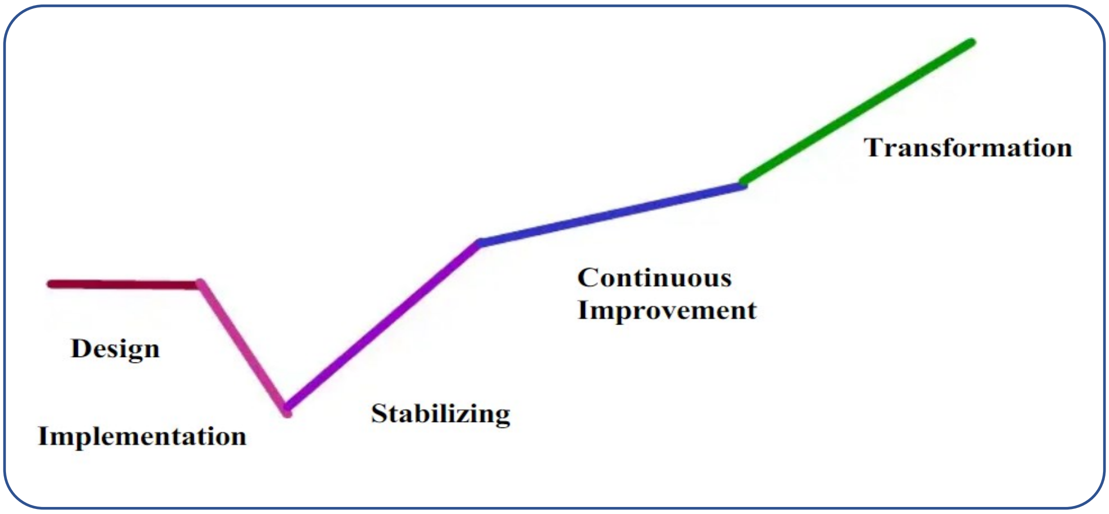
- **ERP Implementation**: This stage includes everything from *project scope determination* to system *installation and cut-over*. *Members of the project team* are chosen, *the project's standards* and *processes* are defined and *changes in business processes* are managed at this stage. In addition, *system configuration, testing, user training, and installation* are all accomplished.

- **ERP Final Preparation**: The final stage of preparation ensures that the system, process, management, and users are all ready for the ERP live-run.
- **ERP live-run**: Performance monitoring and customer input are used to evaluate system performance at this stage. *System repairs, system upgradation* and even system retirement also considered at this stage

The five stages of ERP implementation identified by Ross (1999) are given in the Figure 4.5

Figure4.5

Stages in ERP Journey



Source: *Ross, J. W. (1999). The ERP Revolution: Surviving Versus Thriving. Cambridge, Massachusetts: Sloan School of Management, Massachusetts Institute of Technology.*

Markus and Tanis (2000) described the Enterprise System implementation in four phases. The first phase is the project chartering phase and the remaining three phases loosely correspond to Soh and Markus (1995) Model, labelled as the project phase, the shakedown phase, and the onward and upward phase. Markus and Tanis (2000) explained the key actors, activities, common problems or errors, typical performance metrics and possible outcomes.

First phase: The Chartering Phase: (Pre-implementation phase) This stage comprise of decisions regarding adoption of enterprise system, identification of KPIs (Key Performance Indicators), measurement process, current process analysis, organisational changes measurement, Initial plans regarding system deployment, software selection, decision regarding acceptance or rejection of deployment and approval of project plan

Second Phase: The Project Phase: (Implementation Phase) This stage incorporates the making of the detailed project plan, assignment of team members, training, BPR, software customisation and configuration, change management plan execution, integration, data cleaning, migration, system testing, rollout and system start-up

The third and fourth phases are in the post implementation phase;

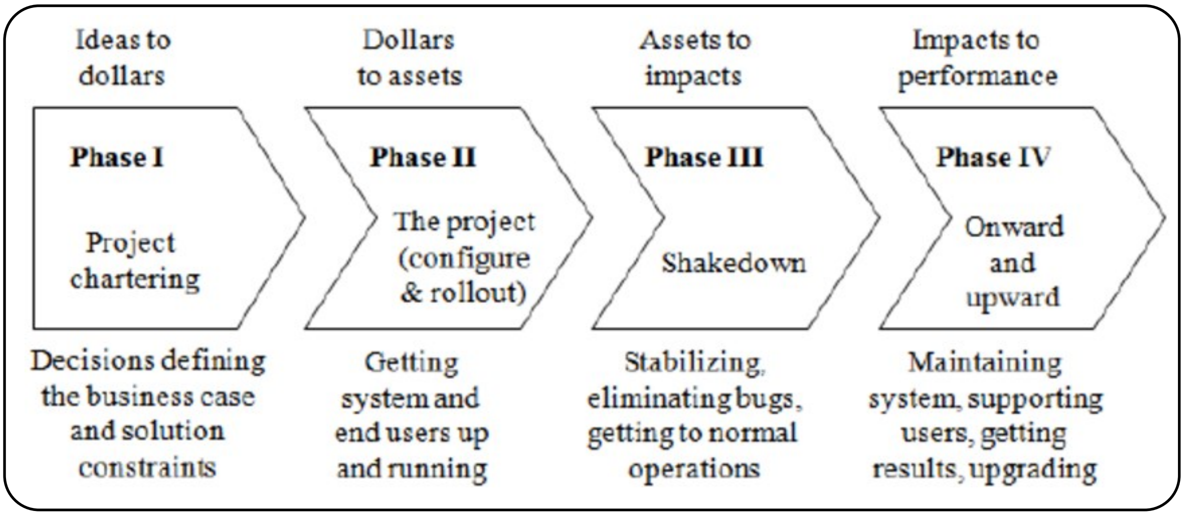
Third Phase: The Shakedown Phase: This phase can also call as the controlling phase of the project. This stage tries to identify the issues, problems and errors like vendor delivery and software performance issues, issues in software ease of use, lack of support from consultants etc. This phase is also focusing on taking remedial measures like short cutting testing and training schedules, bug fixing, retraining and additional training if required, adding hardware capacity etc..

Fourth Phase: The Onward and Upward Phase: Activities like post implementation investment audit, Technology upgradation and maintenance and also considering the additional training to build the end user's skill.

The Figure 4.6 shows the phases explained by Markus and Tanis (2005)

Figure 4.6

ERP implementation Phases



Sources: Markus, L. M., and Tanis, C. (2000). The Enterprise System Experience— From Adoption to Success. Framing the Domains of IT Management, 173-207.

Ram et al., (2013) developed the Stages of ERP implementation by classifying the CSFs of ERP implementation. The identified CSF and the first phase are the Project Management (PM), the identified second CSF and the second stage is the Training and Education (TED), the third CSF and the third phase is the BPR, the fourth identified CSF and the fourth phase is the System Integration (SI) phase, these identified four phases leads to the last phase of implementation i.e., the Implementation success and organisation performance. Thus Ram et al., (2013) classified the five phases of ERP implementation as the factors crucial for the successful ERP implementation

Esteves and Pastor (1999) proposed a six-phase ERP Life Cycle process framework encompassing research issues and influencing variables related to ERP systems in businesses. The identified influencing variables are the CFs in the ERP life cycle that effect the ERP outcome. The influencing CFs were presented in four dimensions in the different phases of implementation. Most of the literatures were focused on the initial phases of ERP implementation, but Esteves and Pastor (1999) were the pioneer to bring the retirement phase in the ERP field. The Table 4.2, presents the different phases of the ERP life cycle and the critical factor associated with each phase.

Table 4.2

Phases of ERP implementation and CSFs

Phases of ERP life cycle	***Critical factors***
Adoption Phase	Kinds of solution Requirements defined
Acquisition Phase	Product selection Consultant selection Contractual agreement Return on investment
Implementation Phase	Methodology selection Implementation strategy or approaches-modular or big bang Time period implementation Project team

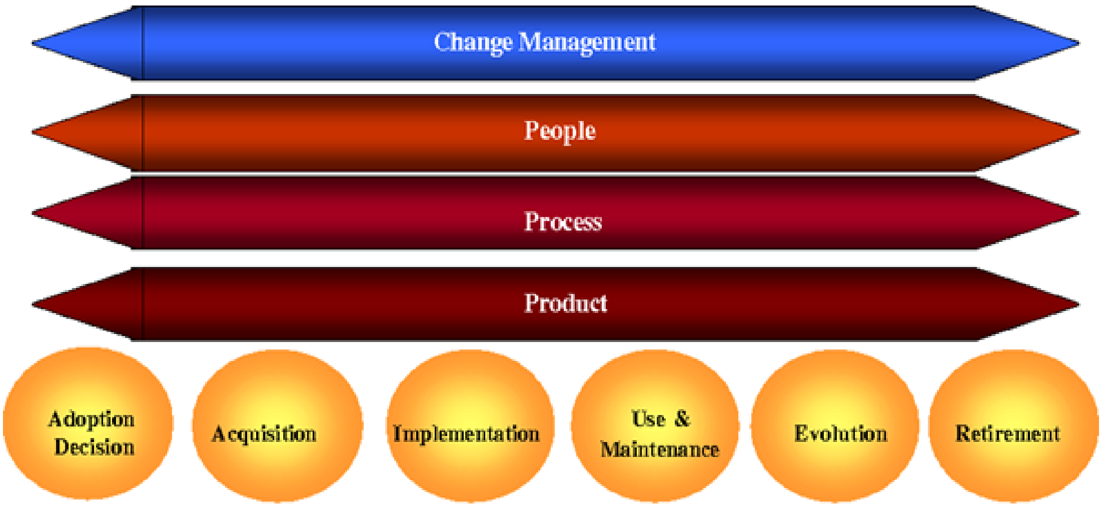
Phases of ERP life cycle	*Critical factors*
	Training Adaptation and data conversion Risk management
Use and Maintenance Phase	Functionality Usability Maintenance Maintenance outsourcing
Evolution Phase	Extended application
Retirement Phase	Kind of application Cost analysis Factors of the "Why" retirement "When" abandon the ERP system. Technology trends

Source: *Esteves, J. m., and Pastor, J. A. (1999). An ERP Life-cycle-based Research Agenda. First International workshop in Enterprise Management and Resource Planning: Methods, Tools and Architectures – EMRPS'99, 1-12.*

The Figure 4.7. displays the six phases of ERP implementation and the four dimensions identified to analyse the different factors involved in the implementation.

Figure 4.7

ERP life cycle

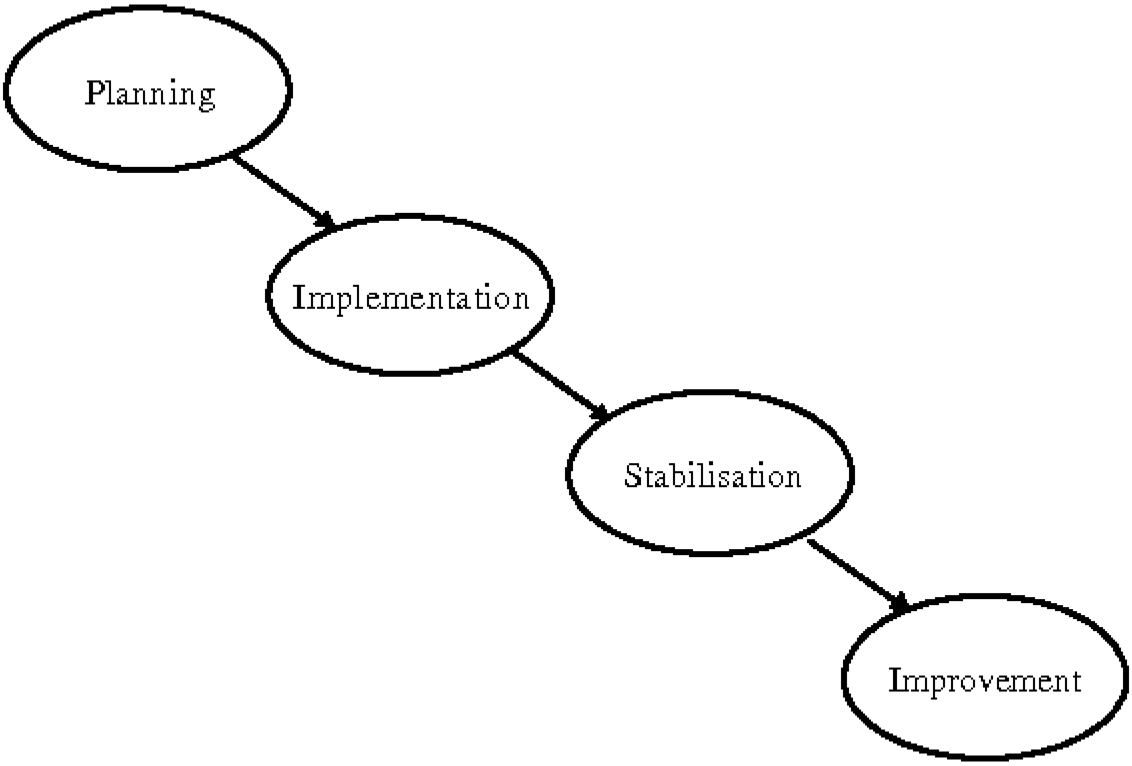


Source: Esteves, J. m., and Pastor, J. A. (1999). An ERP Life-cycle-based Research Agenda. First International workshop in Enterprise Management and Resource Planning: Methods, Tools and Architectures – EMRPS'99, 1-12.

Shanks et al., (2000) developed a four-phase model of an ERP implementation process which is a synthesis model of Markus and Tanis's (2000) ERP implementation process model and Ross's (1999) five phase model. The Figure 4.8. indicates the four-phase model developed by Shanks et al., (2000). The first phase i.e., the planning phase encompasses both the Markus and Tanis chartering phase and the technical project phase of the Ross. The implementation and stabilisation phases are adopted directly from Ross (1999) five phase model. The last phase i.e., the improvement phase commensurate the onward and upward phase of the Markus and Tanis model.

Figure. 4.8

ERP Phase Model



Source: *Shanks, G., Parr, A., Hu, B., Corbitt, B., and Thanasankit, T. (2000). Differences in Critical Success Factors in ERP Systems Implementation in Australia and China: A Cultural Analysis. European Conference on Information System (ECIS) (pp. 537-544). Vienna-Austria: Vienna University of Economics and Business Admin.*

Rosemann (2008) explained that most of the literature on ERP focused only on the implementation issues and that leads to the inadequacy of an accepted ERP lifecycle model. The study thus tried to overcome such situation and thereby introduced a reference process model within the ERP lifecycle. The process models in the ERP lifecycle consolidated and simplified into the following four phases:

1. Business Engineering
2. System Selection
3. System Implementation
4. System Use and Change

Based on the contribution of Markus and Tanis (2000) four phase model and Ross (1999) five phase model, Dibbern et al., (2002) proposed a four-phase model of ERP implementation. Along with the model, the study also specified the critical task associated with each phase and the duration required to accomplish each phase of ERP implementation. The phases of ERP implementation and the critical task corresponding to the proposed stages of implementation and the duration of each stage are given in the Table 4.3.

Table 4.3

Tasks in the lifecycle of an ERP system

Phases	***Tasks***
Acquisition (several months)	▪ Define specification ▪ Select an ERP package
Implementation (6 months to 3 years)	▪ Define the target concept, including a detailed description of the business processes to be supported (potentially after reengineering) ▪ Install IT-infrastructure and ERP software package ▪ Configure and possibly modify the ERP package; also documentation ▪ Build interfaces to other systems and data conversion ▪ Test and rectify errors ▪ Train end-users (including user documentation) ▪ Roll-out and switching to productive operations
Stabilization (up to 6 months)	▪ Rectify errors in the ERP system (within the configuration or modification) or IT-infrastructure

Phases	*Tasks*
Operation and Improvement (10 - 15 years)	▪ Modify business routines. ▪ Improve systems performance (e.g., via expansion of hardware) ▪ Repeat training or provide additional training ▪ Implement updates or new releases. ▪ Support users and provide delta training. ▪ Operate ERP-system (IT-infrastructure and ERP-Basis) ▪ Continuous process improvement and respective system tailoring

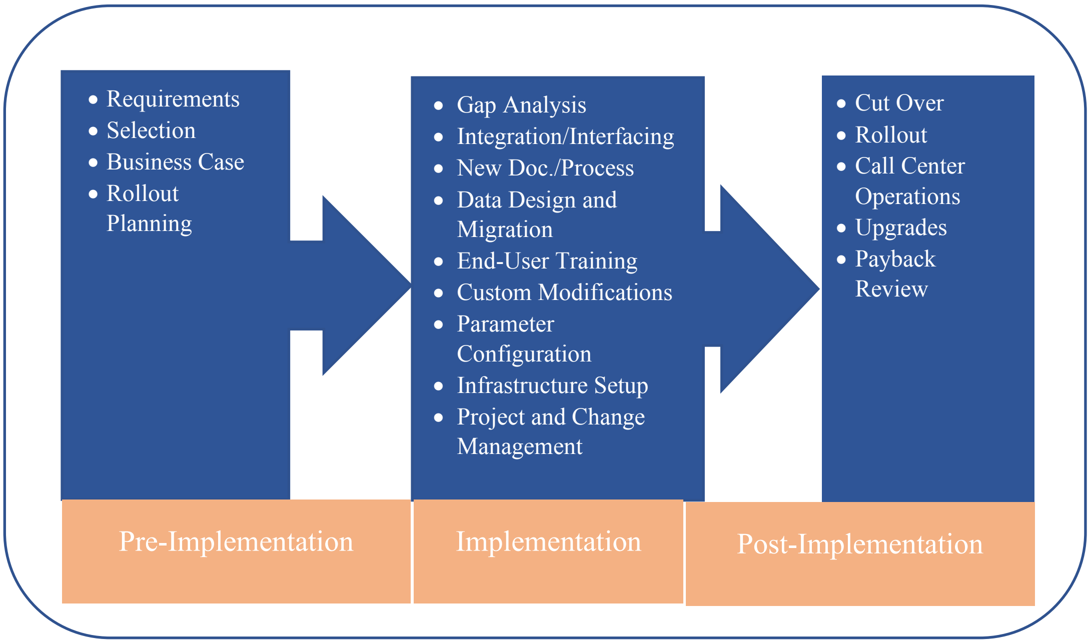
Source: Dibbern, J., Brehm, L., and Heinzl, A. (2002). Rethinking ERP-Outsourcing Decisions for Leveraging Technological and Preserving Business Knowledge Abstract. *35th Annual Hawaii International Conference on System Sciences* (pp. 2770-2779). NW Washington, DC, United States: IEEE Computer Society.

Shanks et al., (2000) also identified eleven CSFs corresponding to the developed four phase model of the ERP implementation process from the case study conducted. Those CSFs are Top Management Support, External Expertise, Balanced Project Team, Data Accuracy, Clear Goals, Project Management, Change Management, Education and Training, Presence of a Champion, Minimal Customisation and Best People full-time (Project Team Members)

Chang and Gable (2000) analysed the major issues with SAP Financials implementation, management, and/or support in the life cycle of ERP implementation. The study developed an ERP life cycle model and presented the CSFs by classifying the life cycle into three stages, the Pre-implementation, the Implementation and the Post-implementation phases, which is presented in the Figure 4.9

Figure 4.9

ERP life cycle



Source: *Chang, S.-I., and Gable, G. G. (2000). Major Issues with SAP Financials in Queensland Government. Americas Conference on Information Systems (pp. 972-976). California: Association for Information Systems AIS Electronic Library (AISeL).*

Brehm and Markus (2000) proposed a Divided Software Life Cycle Model, an extension of the traditional Software Life Cycle Model. The traditional SLC Model was often developed from the perspective of ERP adopters, but DSLC model developed by interrelating the vendor's and adopter's activities. The DSLC model was categorised into three stages:

I. Initial Development and Adoption of the ERP package

Factors considered: - System analysis, System design, System coding and testing

II. Evolution of the ERP package and Adopter's Implementation of it

Factors considered: - Upgrades.

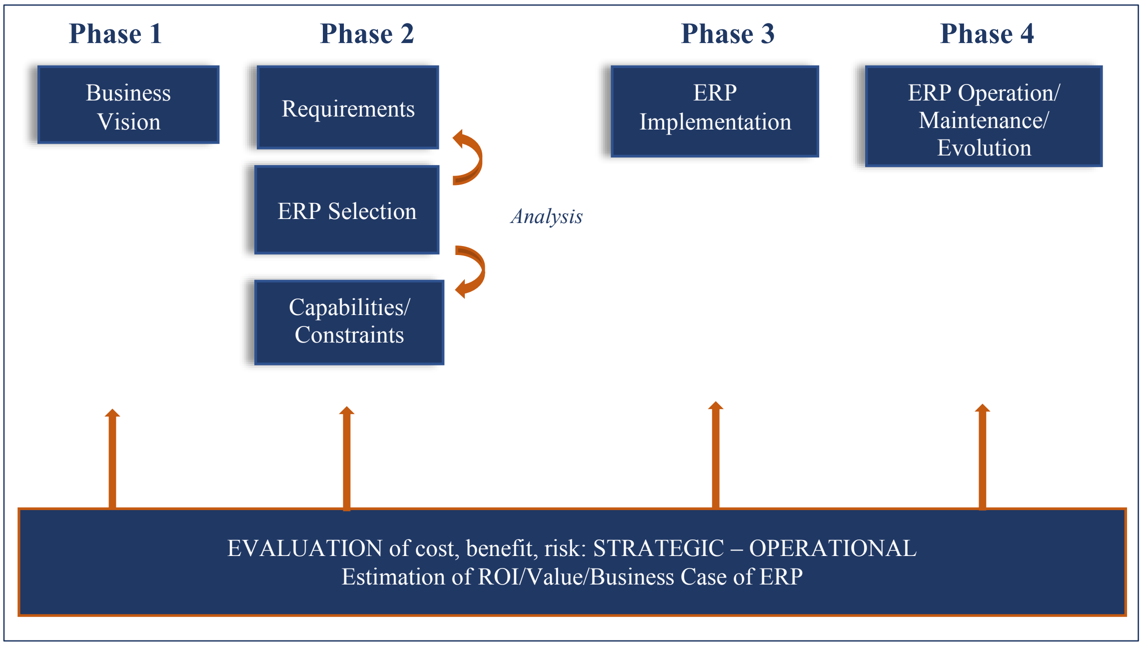
III. Feedback from Adopter to Vendor

Factors considered: -bug fixes and enhancements.

Stefanou (2001) emphasised the significance of the ERP selection method and ERP system's ex-ante evaluation. The study included the cost benefit analysis (both financial and non-financial) and the long-term influence of ERP systems on organisations, technology, and behaviour, which must be considered throughout the ERP system's life cycle. The proposed ERP life cycle is given in the Figure 4.10.

Figure 4.10

Major phases of ERP lifecycle

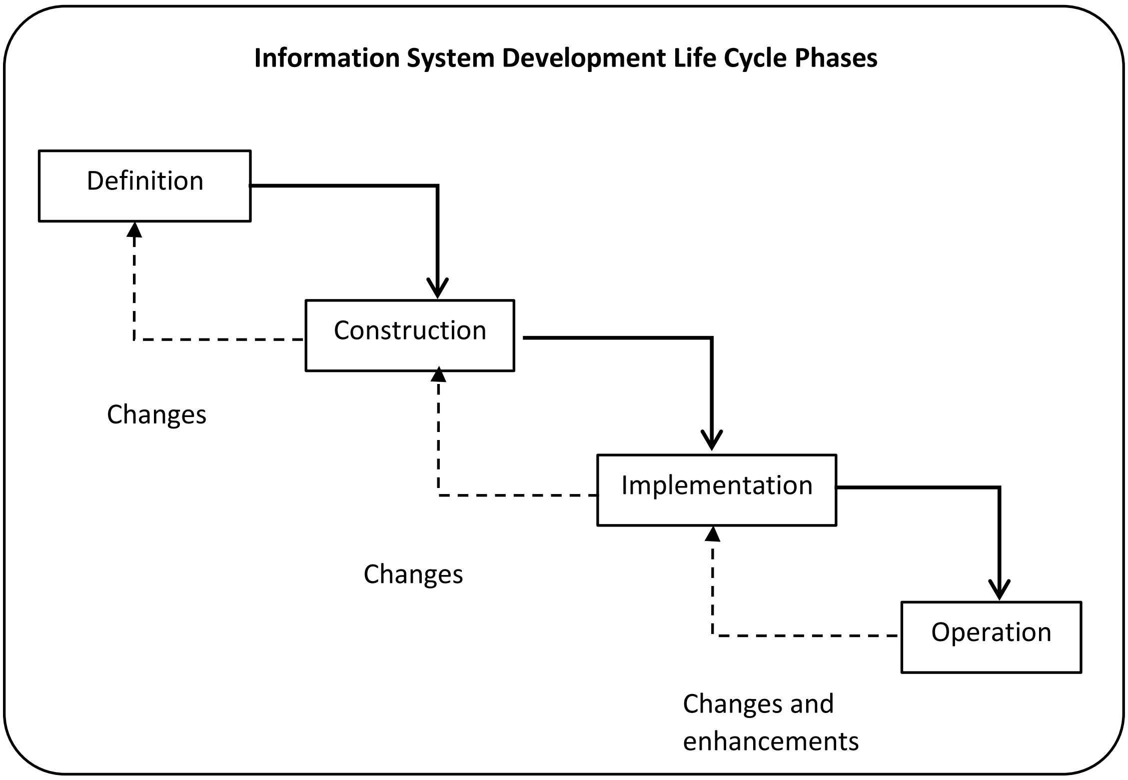


Source: Stefanou, C. (2001). A framework for the ex-ante evaluation of ERP software. *European Journal of Information Systems*, 204-215.

Ahituv et al., (2002), after reviewing the three major traditional approaches of SDLC models, developed a new structural methodology. They developed the model by combining the features of the conventional models-The Information System Life Cycle (The Waterfall Model), The Prototyping Model and the Application Software Package Model. The developed ERP life cycle model is presented in the Figure 4.11

Figure 4.11

ERP Life Cycle Model



Source: Ahituv, N., Neumann, S., and Zviran, M. (2002). A System Development Methodology for ERP Systems. *Journal of Computer Information Systems*, 56-67.

The factors considered in each stage of implementation in the model developed by Ahituv et al., (2002) are:

The Selection Phase: Project Objectives, Collection of information about systems, Vendors, Consulting firms and Technological infrastructure, Organisation's requirement analysis, Investigation on vendor alternative and Consultant alternatives, Feasibility study and Negotiation.

The Definition Phase: Project scope, Establishing implementation teams and timetable, Implementation team training and Initial implementation of the system.

The Implementation Phase: Gap analysis, BPR, Identification of complementary solutions, Construction of a prototype, Data conversion, Definition of work procedures, Full implementation of the systems, User training and Acceptance tests.

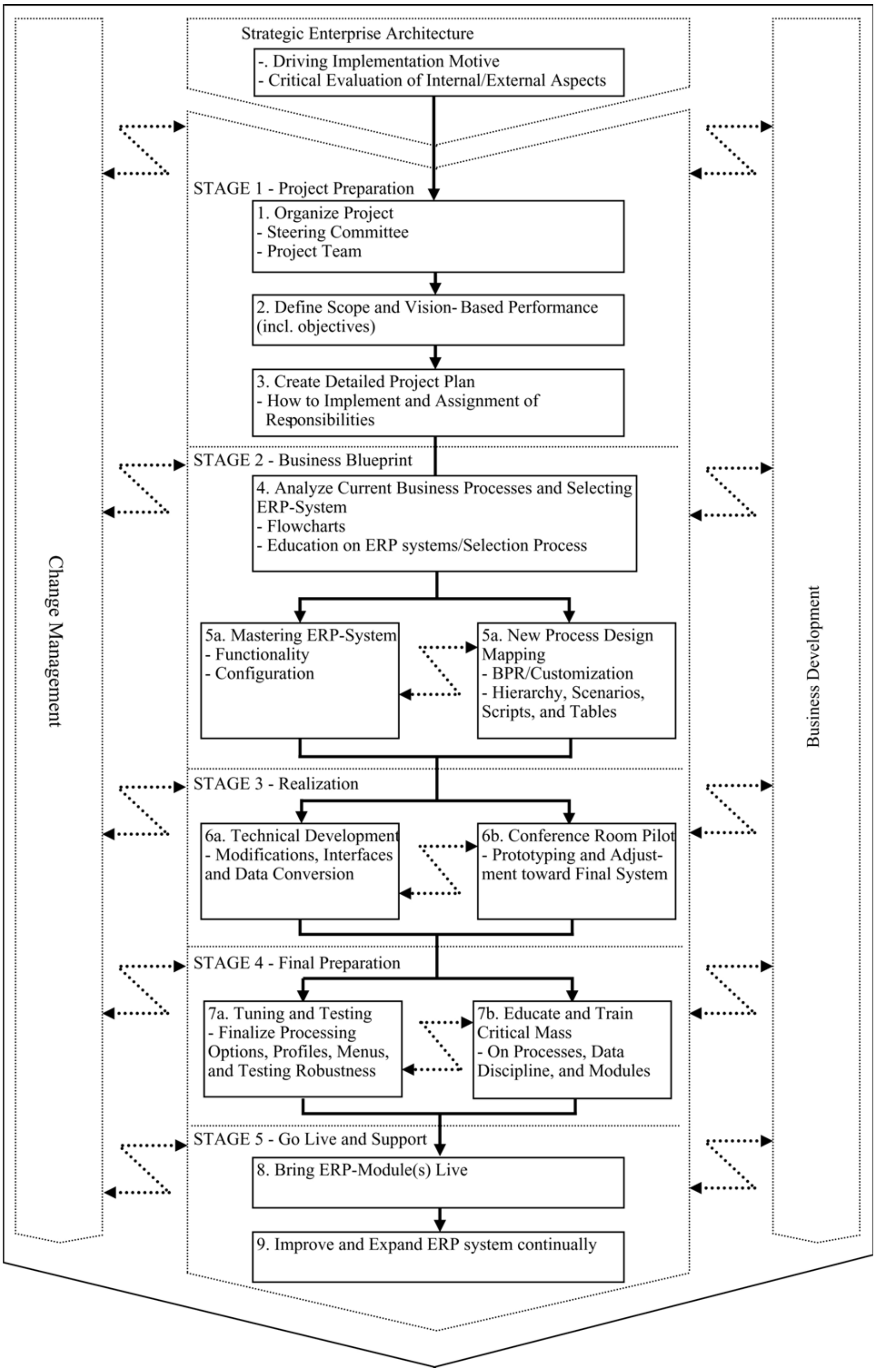
The Operations Phase: Establishment of support centres, Performance of changes and enhancements, Upgrading the system, System audit, System termination

Ehie and Madsen (2005), explained the five phases of the ERP implementation process based on literature reviews and interview with the experienced consultants. The Figure 4.12. demonstrates the different phases of ERP proposed by Ehie and Madsen (2005). The study also emphasised the CSFs in the ERP implementation process and identified eight factors which are very significant in ERP implementation. The eight CSFs are

1. Project management principles
2. Feasibility/evaluation of ERP project
3. Human resource development
4. Process re-engineering
5. Top management support
6. Cost/budget
7. IT infrastructure
8. Consulting services

Figure 4.12

The Different Phases of ERP

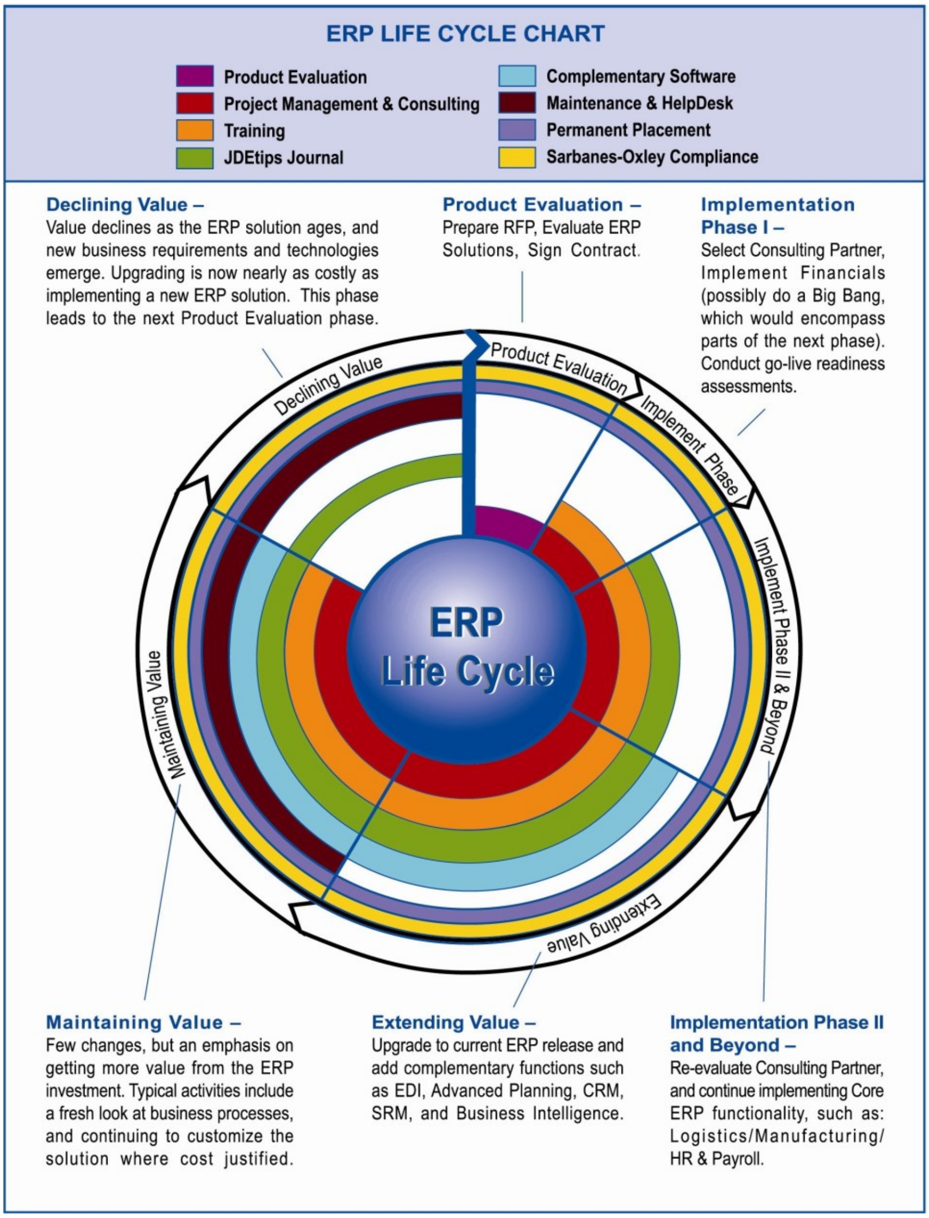


Source: Ehie, I. C., and Madsen, M. (2005). Identifying Critical Issues in Enterprise Resource Planning (ERP) Implementation. *Computers in Industry*, 545-547.

Klee (2005), The president of Klee Associates (ERP vendor company), from his sixteen years practical experience developed an ERP lifecycle chart, a six phase framework, from the view point of the vendor which is shown in the Figure 4.13. The study also identified the critical activities in each phase and explained the values that ERP will provide to businesses.

Figure 4.13

ERP Life Cycle Chart

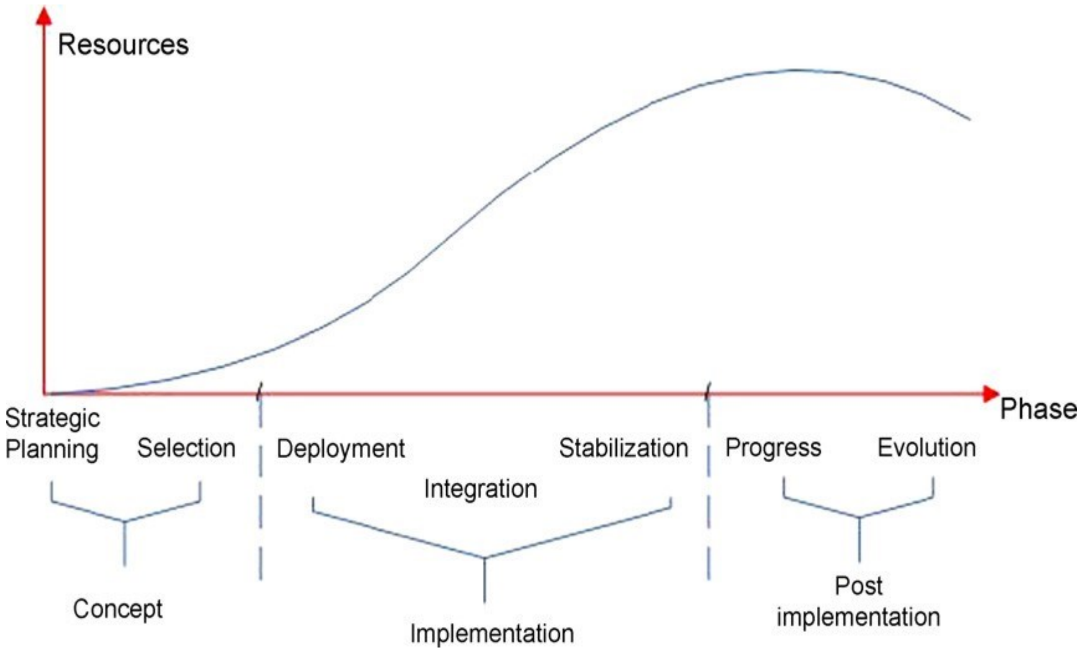


Source: Klee, A. (2005). *The ERP Life Cycle: From Birth to Death and Birth Again*. Retrieved from hosteddocs: http://hosteddocs.ittoolbox.com/AK051305.pdf (accessed November 1, 2021)

Aloini et al., (2007) described the ERP lifecycle model in three phases by readapting the models from previous studies. The three phased model is shown in the Figure. 4.14. The study also explained the nineteen critical risk factors in the implementation process which lead to the implementation failures which are not considered in the present study as the present study is focusing only the success factors and its impact

Figure 4.14

ERP Life Cycle



Source: Aloini, D., Dulmin, R., and Mininno, V. (2007). Risk management in ERP project introduction: Review of the literature. *Information and Management*, 547-567.

Desai and Srivastava (2013) identified a nineteen major steps for implementing the ERP application which are as follows

1. Identification of business problem(s)
2. ERP implementation-readiness evaluation
3. Launch the ERP implementation project
4. Package or project evaluation
5. Selecting the implementation partner

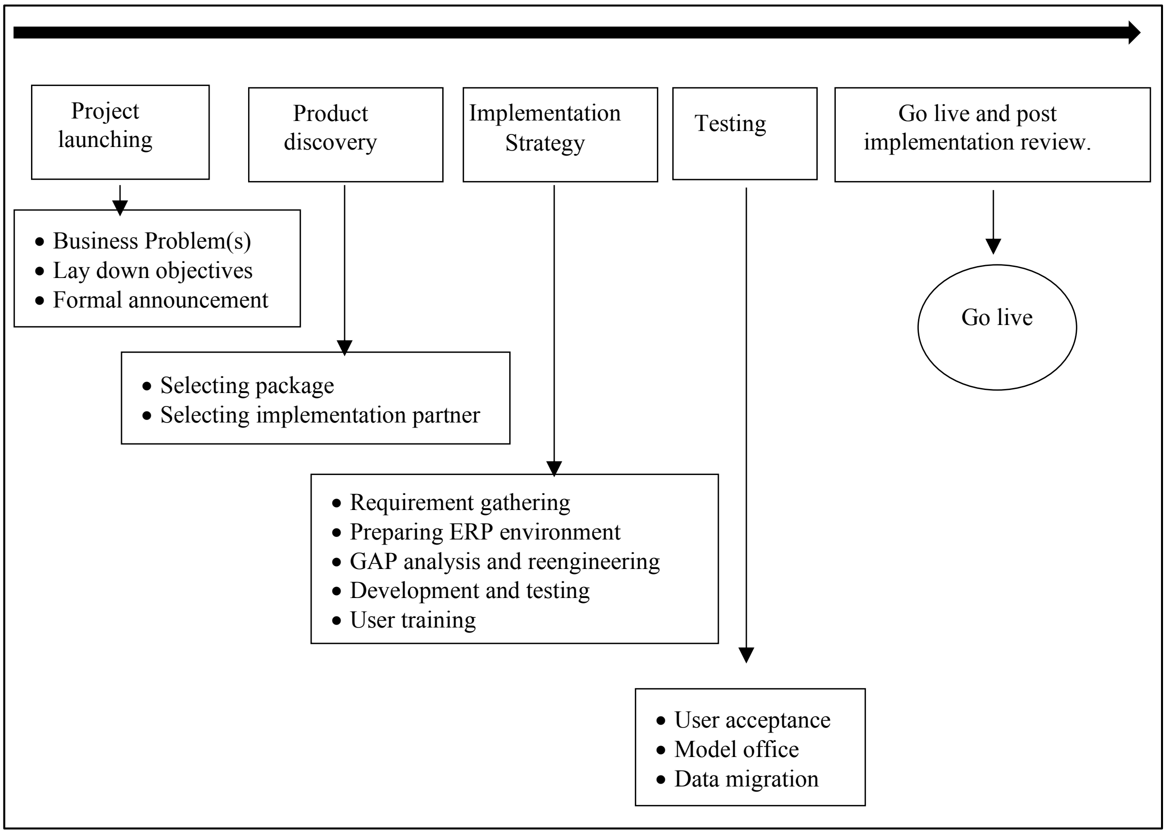
6. Develop an implementation strategy
7. Requirement gathering
8. Preparing ERP solutions environment
9. GAP analysis
10. Reengineering
11. Development
12. Testing
13. User training
14. User acceptance test
15. Model office testing
16. Data migration
17. Go live
18. Support
19. Post implementation review

The majority of the organization will go through the above-mentioned stages or sometimes drop some of the stages if required.

Desai and Srivastava (2013) again, classified the implementation process into five phases and the CSFs under these phases in a more logical way as given in the Figure 4.15

Figure 4.15

ERP implementation Phases



Source: *Desai, S., and Srivastava, A. (2013). ERP to E ^{2}RP- A case study approach. Delhi: PHI Learning Private Limited.*

Sun et al. (2015) proposed a five stage ERP implementation model. Which are

Stage 1: ERP organisational readiness: A steering committee will conduct a *gap analysis* so as to accommodate the requirements for ERP implementation

Stage 2: ERP selection: Develop a short list of ERP packages and implementation partners and will conduct an indebt evaluation of the same so as to finalise the *package and implementation partners*

Stage 3: ERP implementation: *Project team selection, establishment of projects standards and procedures, incorporating customer requirements, BPR,* *System configuration, testing, user training, and installation* will consider at this stage

Stage 4: ERP final preparation: This is the stage of ensuring whether the system, process, management and users were prepared for the implementation

Stage 5: ERP live-run: Assessment of performance in every six months through *performance monitoring and customer feedback*. The assessment aids the *system repair* issues, extension, transformation, system updating and also system retirement if required.

The ERP implementation life cycle has been defined by Ahlawat (2013) in twelve stages which are

- Pre-evaluation of available packages
- Evaluation and selection of packages
- Requirement Analysis
- Project Planning
- Gap Analysis
- BPR
- Design and customisation phase
- Implementation team training
- Testing and Analysis
- Going Live
- Training the staff and management
- Post implementation evaluation

Varman (2007) defined the implementation stages and the critical factors associated with each stage along with the duration of each stage of implementation, which is presented in the given Table 4.4

Table 4.4

Implementation phases, time period and CSFs

Phases	CSFs	Time period (In years)
Selection	▪ Determine current state ▪ Identify the key process flow ▪ Design future state ▪ Process Mapping and Gap Analysis ▪ Negotiate ERP software terms	Pre-cycle
Implementation	▪ Select ERP implementation partner ▪ Identify executive sponsors ▪ Build IT and business leader owners ▪ Determine program management ▪ Design ongoing knowledge management and transfer process	0-1
Utilization	▪ ERP software is now in full usage ▪ Business requirements are collected for future enhancement requests ▪ Changes in business structure affect software usage	Years 1-5
Maintenance	▪ Some regulatory enhancements are provided ▪ The Vendor is likely to withdraw support or to encourage ERP upgrades	Year 6-10
Retirement	▪ Replacement of ERP software is now required as customization renders ERP upgrade obsolete. It is time to go back to the vendor selection phase	10 years through pre-cycle

Source: *Varman, J. N. (2007). ERP in Practice-ERP strategies for steering organisational competence and competitive advantage. New Delhi: Tata McGraw-Hill.*

Law et al., (2010) identified the CSFs in four stages of ERP implementation

i. Initiation- Implementation Strategy (Preferred vanilla; Minimal customisation),

ii. Contagion- Client vendor alignment and co-operation, Support and participation, Ability to leverage ERP expertise from multiple sources and Communication and Coordination

iii. Control

iv. Integration- M and S Strategy and Focuses and Implementation outcome.

According to Alizai (2014) there are six stages of implementation and the study classified the CSFs in these stages which includes

i. Pre-Planning

ii. Planning-Technical Factors (Impact of technology and business requirements, time and cost of implementation, ERP complexity, new technology adoption)

iii. Set up and Re-Engineer: -Organisational factors (Change management, risk management and monitoring, project management, organisational resource management, managerial style, organisational structure, communication and coordination)

iv. System Design

v. Configure and Test: - People Factors (Communication strategies, training and change management strategies, in-house expertise, staff attitude to change, end user engagement, management attitude)

vi. Installation and Go Live: Midsize business factors (Business and technology issues, strategic management issues, ICT application selection, limited resources (time, budget, skill))

Dantes and Hasibuan (2011) identified the CSFs in the five stages of ERP implementation

i. Project Preparation: - organisation's maturity level, formulation of clear goals and objectives, BPR and Evaluation of IT investment

ii. Technological Selection: Selection of ERP project team, Steering committee and Project manager, Selection of consultant, Project scope and schedule preparation and the selection of ERP implementation strategy or approaches, ERP product or vendor selection, database product selection and hardware product selection.

iii. Project formulation: functional requirement building (modules), development of implementation plan, change management, risk management and decision on data migration.

iv. Implementation / Development: Project monitoring, user acceptance test, user training, ERP customisation, risk management and change management, integration with legacy system, functional testing, data analysis and migration, data testing, installing hardware and hardware testing.

v. Deployment: Going live, evaluation and audit system and up gradation

Bento and Costa (2013) classified the CSFs into three stages of ERP implementation

i. Pre-Implementation: Selection/Acquisition-ERP requirement analysis, functional analysis of ERP (modules of ERP) and price of ERP software

ii. Implementation:

- Implementation/Use- Consultant services, User's training, data entry, configuration, adaptation and BPR
- Stabilisation- Adaptability, Service Quality, Users, Uses and Data quality

i. Post-Implementation:

- Stabilisation-Adaptability, Service Quality, Users, Uses and Data quality
- Decline-Technical Assistance, Training, Change Management, Up gradation and Maintenance

After reviewing various literatures on ERP implementation phases, process of ERP implementation and the CSFs, the study in the following Table 4.5 listed the significant CSFs

Table 4.5

Literatures on CSFs

Citation	CSFs
Yusuf et al., (2004)	Project Team, BPR, EPR consultants, Data migration, data management, Training, ERP core team and Manpower
Kotiranta (2012)	Vendor Evaluation, Vendor Viability and Vendor Scalability
Vuksic and Spremic, (2005)	BPR, Employee training, Project management, Implementation approaches and Consultants and BPR
Sastry and Babu (2013)	Vendor viability, Customisation and Training
Samuel and Kumar (2013)	Users, Top management, Project team, Vendor and Consultant
Mabert et al., (2003)	ERP vendors, ERP Packages, Modules Modifications, Consultant, Project time, Project Cost, Implementation team, BPR, training, Implementation Approaches, Data integration and Technological Infrastructure
Hustad and Olsen (2011)	ERP Vendor, Reseller (local partner representing vendor) and Consultant
Motwani et al., (2005)	Top Management Commitment, Cultural and Structural Changes, Project Management, ERP package, Analysis of current business process and Implementation team
Al-Mashari et al., (2003)	ERP Package selection, Training and Eductaion, system integration, system testing, Legacy

Citation	CSFs
	system management, Cultural and Structural Changes and performance evaluation and management,
Parthasarathy (2007)	Project planning, Identification of ERP vendor, Evaluation of ERP package, GAP Analysis, Reengineering, Customisation, ERP team training, Product testing, Training and Maintenance.
Sun et al., (2015)	Organisation Readiness, ERP Selection, System configuration, testing, user training, System repairs, upgradation and system retirement
Rajan and Baral (2015)	BPR
Salimi (2005)	Implementation partner, Gap analysis, training and testing
Pattanayak and Roy (2015)	Users, top management, Project team, vendors and consultant
Abdinnour-Helm et al.,(2003)	Consultant involvement, training and employee attitude
Olhager and Selldin (2003)	ERP package and customisation and Implementation Approaches.
Zaglago et al., (2013)	Cultural Factors
Ahmadi et al., (2015)	Organisational Readiness, technical readiness, social readiness and total readiness node
Kilic et al., (2015)	Project Cost
Ram et al., (2013)	Project Management, Training and Development, System Integration and BPR

Citation	CSFs
Nah and Lau (2001)	Team work's composition, top management support, effective communication, efficient project management, BPR, minimum customisation, software development-testing and troubleshooting.
Upadhyay et al., (2011)	Project execution competency, package and vendor perspective, organisational climate and technical perspective or infrastructure
Pabedinskaitė (2010)	Top Management Support, timely training and education of employees and BPR
Sternad and Bobek (2006)	Project Team, User Training And Education, BPR and Change Management, Effective Communication, User Involvement, Data Analysis and Conversion, Consultants, Project Management, Project Champion, Architecture Choices (Package Selection) and Minimal Customisation
Al-Fawaz (2012)	Top management commitment, external advisory support, vendor partnership and end user involvement, BPR, customization, implementation approaches, Package requirement and selection and system testing project management, Consultant and Vendor Evaluation and Selection, budget-cost parameters and Time, change management, effective communication, organization structure and culture and training and education
Rahman and Saha (2015)	Package selection, legacy system management, consultants, vendors and customer relationship, post evaluation, maintenance and upgrade and Audit
	Proper auditing program, adequate training and testing and post implementation evaluation.

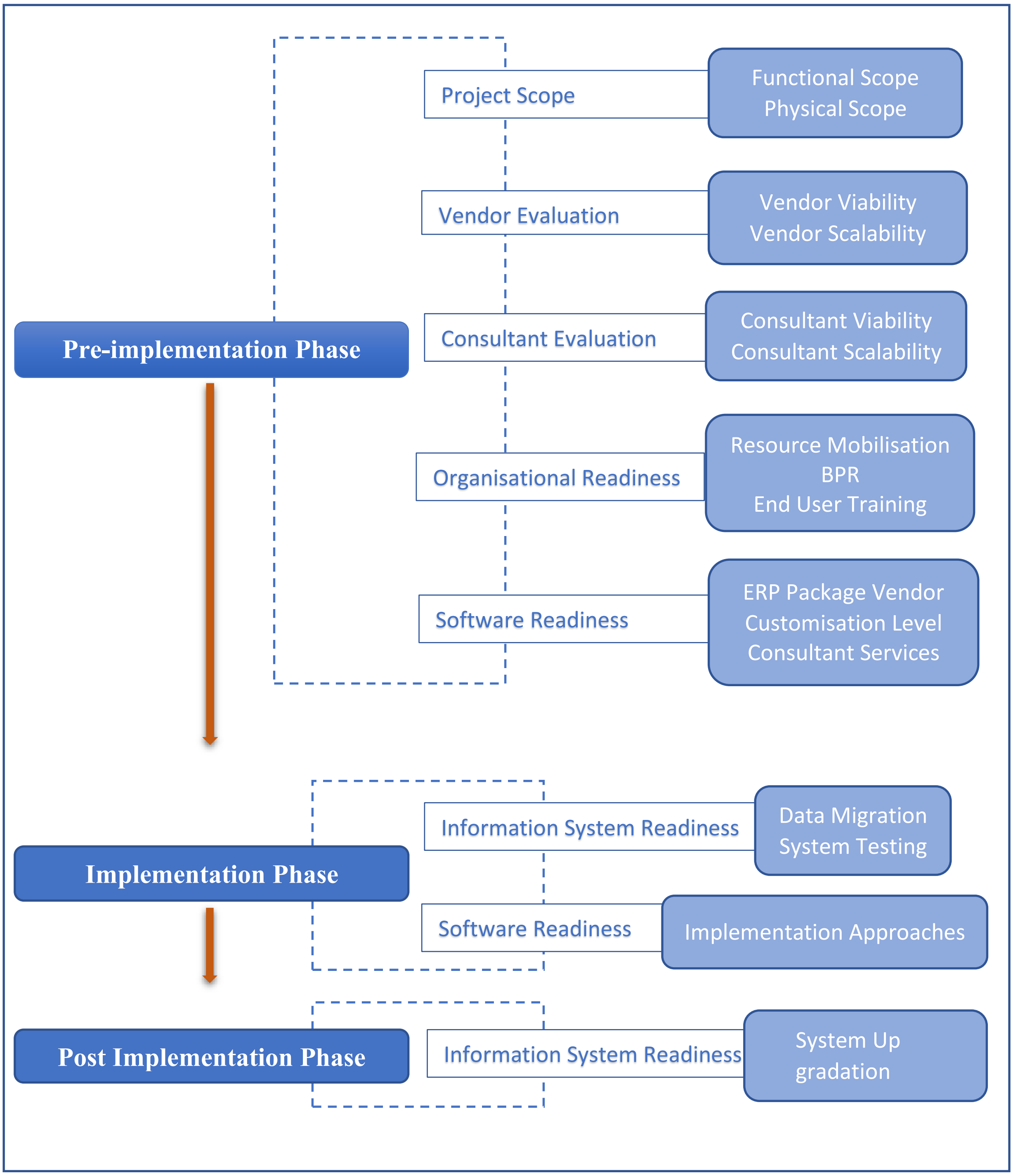
Citation	CSFs
Vayvay et al., (2012)	Consultant Evaluation and selection
Bishnoi (2011)	Top management support, Business Plan and Vision, Re-engineering business process, effective project management and project champion, team work and composition, ERP system selection, user involvement and education and training

4.3 Phases and CSFs in the Process of ERP implementation

The objective of this chapter is to identify the process of ERP implementation adopted by different organisations from various literatures and to select the significant CSFs involved in different phases of ERP implementation. From the literatures, it was found that CSFs are spread in different phases of ERP implementation and most of the CSFs are distributed in different phases in different literatures. Hence, to ensure an exact division of CSFs into a particular phase of ERP implementation, the study classified the ERP implementation into the basic three stages, The **Pre-implementation Phase, Implementation Phase and Post Implementation Phase.** From the literatures, expert's opinion and after validation, the study identified 16 CSFs and these 16 CSFs are classified under the three phases of ERP implementation and the process involved in these phases, which is given in the Figure 4.16

Figure 4.16

ERP implementation process and CSFs



4.4 Summary

This chapter of the study focused on identifying the process adopted by different organisations for the efficient and effective implementation of ERP system, from the literatures on ERP implementation and subject experts. After the literature reviews, it was found that, organisations are going through different phases, for a successful implementation of the ERP system. In order to conclude the different phases, the study classified the phases into three basic phases of implementation: the Pre-implementation phase, Implementation phase and Post-implementation phase. The study also listed the activities required to be carried out for the ERP roll out in these three phases. Finally, the chapter ends by listing the identified CSFs involved in different phases of ERP implementation. It found 16 CSFs which have a significant role in the ERP implementation. The ultimate object of this chapter is to identify the CSFs for measuring the impact of these CSFs on the capability of the organization and its financial performance which is analysed in the latter part of the thesis.

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Chapter Five

CSFS: ERP PROJECT TIME AND COST

5.1 Introduction

This section of the study attempted to reveal the variations in time and cost of ERP implementation of different manufacturing enterprises due to differences in the method of applying the selected CSFs in the process of ERP implementation.

5.2 Profile of the Enterprises

To explain the profile of the enterprises, the study classified the organisations on the basis of market capitalisation, the state which the enterprises belong to, as per EU KLEMS classification of enterprises, on the basis of the amount invested in ERP and the duration of ERP implementation.

5.2.1 Classification of Enterprises

a. Classification of Enterprises (Market Cap)

The study is conducted on the large and medium capitalized listed manufacturing enterprises in India. The following table 5.1 shows the number of large and medium cap enterprises included in the study

Table 5.1

Classification of Enterprises (Market Cap)

Market Capitalisation	No. of Organisation	Percent
Large Cap	59	36.9
Medium Cap	101	63.1
Total	160	100.0

The sample includes 63.1% from medium cap companies and only the remaining 36.9% from large cap companies

b. Classification of Enterprises (State Wise)

The study gathered data from both large and medium cap enterprises from the selected three states of India. The table 5.2 shows more details about the sample selected as per state and as per market capitalisation.

Table 5.2

Classification of Enterprises (State Wise)

State	Market Cap	No. of Organisation	Total	Percent	Total
Gujarat	Large Cap	7	27	4.375	16.875
	Medium Cap	20		12.5	
Maharashtra	Large Cap	41	97	25.625	60.625
	Medium Cap	56		35.00	
Tamil Nadu	Large Cap	12	36	7.5	22.5
	Medium Cap	24		15.00	
Total		160	160	100.0	100

c. Classification of Enterprises (EU KLEMS)

As a part of the EU KLEMS project, funded by the European Commission, Research Director General. Ark (2005) tried to introduce the growth and productivity accounts, which includes quantity and prices of output, K (Capital), Labour (L), Energy (E), Material (M), and Services inputs at the industry level as per the EU KLEMS 72- industry classifications (EUK72). The project of Das et al., (2018), Centre for Development Economics, Delhi School of Economics, funded by RBI, classified industry into 27 sectors.

The present study was unable to identify certain industry in the 27 sectors industrial classifications as per the report submitted by Das et al., (2018). So, the present study classified the industries as per the EU KLEMS 72 industrial classification (Annexure III). Because the classification of industries propounded by the EU is a wider list of having 72 classifications of industrial sector and the present study identified by the required industrial codes from the EU KLEMS database which is given in the table 5.3.

Table 5.3

Classification of Enterprises (EU KLEMS)

Code	Industry	Total
15t16	Food Products and Beverages	22
26	Other Non-Metallic Mineral Products	4
17t19	Textiles, Textile Products, Leather and Footwear	12
23t24	Chemical, Rubber, Plastics and Fuel Products	48
25	Rubber And Plastics Products	16
27t28	Basic Metals and Fabricated Metal Products	9
30t33	Electrical And Optical Equipment	30
34t35	Transport Equipment	15
36t37	Manufacturing Nec; Recycling	4
	Total	160

5.2.2 ERP Implementation Project Cost

The study in the table 5.4 presents the total ERP implementation project cost involved in the process of ERP implementation. In the table the organisations are classified as per the amount spent on ERP implementation.

Table 5.4

ERP Implementation Project Cost

ERP Implementation Cost [Rs. Crore]	No. of Organisations
1 - 5	48
6-10	33
11-15	51
16 -20	13
21 - 25	6
26 -30	1
31 - 35	2
36 - 40	0

ERP Implementation Cost [Rs. Crore]	No. of Organisations
41 - 45	1
46 - 50	1
51 - 55	3
56 - 60	1
Total	160

Table 5.4 presents the total cost of ERP implementation. The organisations spent from around one crore to sixty crores on ERP system implementation. The majority of the organisations had invested rupees eleven crores to fifteen crores on ERP and about 48 organisations spent a minimum amount i.e., around one to five crores.

5.2.3 ERP implementation Project Time

From the primary data collected, the study identified at the time taken by the organization for implementing ERP system. Table 5.5 presents the classification of the duration of ERP implementation into different intervals and also shown the number of organization belongs to each interval.

Table 5.5

ERP Implementation Project Time

Duration [Months]	No. of Organisation
1 – 5	3
6 - 10	77
11 - 15	60
16 - 20	10
21 - 25	4
26 - 30	3
31 - 35	0
36 - 40	1
41 - 45	0
46 - 50	2
Total	160

From the table 5.5 it can understand that most of the organization took six to ten months for the implementation of ERP software and 60 of them implemented ERP system within eleven to fifteen months. Hence, the study found that the majority of the organization's duration of ERP implementation falls within six to fifteen months.

5.3 Respondents' Profile

The study aimed to collect samples from the General manager (impact part of the Questionnaire and for the general information) and ERP Head/IT Head (ERP related part of the questionnaire). So the study used 320 respondents to meet the sample size of 160.

5.3.1 Designation of the Respondents

The study collected the primary data from the General Manager and from the ERP/IT Head of the organisations. Here, in Table 5.6, the study presents the number of respondents in the primary data collection.

Table 5.6

Respondents' Designation

Designation of the respondents	Responses
General Manager	160
ERP Head/IT Head	160
Total	320

5.3.2 Experience of the Respondents'

The study tried to gather data from the respondents who have more than three years of experience in the present organization and the experience in ERP System. Except 8 of the 320 respondents had more than three years of experience in both the present organization and in the ERP system. The table 5.7 shows the experience of the respondents in the present organization and their total ERP experience.

Table 5.7

Respondents' Experience

Experience	General Manager (present organisation's Experience)	General Manager (Total ERP Experience)	ERP/IT Head (Present organisation Experience)	ERP/IT Head (Total ERP Experience)
Below 3 years	0	0	8	0
3 to less than 5 years	97	65	112	6
5 to less than 10 years	45	82	40	21
Above 10 years	18	13	0	133
Total	160	160	160	160

5.4 Validation of Lower Order Constructs (LOCs):

It is important to check the quality criteria of the constructs through factor loadings, reliability and validity. Here Smart PLS is used to evaluate the factor loadings followed by establishing the reliability and validity of the constructs. Through reflective and formative measurement model, the study conducted the CFA

5.4.1 Confirmatory Factor Analysis (CFA)

The first part of the chapter included the CFA for the assessment of the measurement models of those constructs which used measurement scales for collecting data for analysis. The study used the disjoint two stage approach and considered the Lower Order Constructs (vendor scalability and vendor viability of vendor evaluation, consultant scalability and consultant viability of consultant evaluation, resource mobilisation, BPR and end-user training of organisational readiness, data migration, system testing and system upgradation of information system readiness) in the first stage of validation. The Lower Order Constructs can measure by the threshold of Factor loading, Multicollinearity (VIF), Internal

Consistency Reliability (Cronbach Alpha), Composite Reliability and Construct Validity through Convergent Validity (AVE) and Discriminant Validity.

A. vendor evaluation Measurement Model

Here CFA is used to assess the robustness of the two-factor model of vendor evaluation. CFA was carried out by using the software 'Smart PLS 3.0', which is given in the following table 5.8.

Table 5.8

Validity Indices – Vendor Efficiency Measurement Model

LOC and items	Factor Loadings	Indicator Multicollinearity (VIF)	Cronbach's Alpha	Composite Reliability	Convergent Validity (AVE)
Vendor Viability					
VDV1	0.414	2.497	0.845	0.795	0.513
VDV3	0.875	2.273			
VDV4	0.888	1.561			
VDV5	0.567	2.937			
Vendor Scalability					
VDS1	0.855	1.799	0.805	0.884	0.718
VDS2	0.801	1.644			
VDS3	0.884	1.810			

I. **Factor Loading**: From table 5.8, VDV1, VDV3, VDV4, VDV5, VDS1, VDS2 and VDS3 shows a factor loading more than the minimum criterion of 0.50, hence these factors have higher correlation. Even though the VDV1 shows a factor loading less than 0.50 which is insignificant, it is not considered for removal as the removal of this low loading indicator does not make any improvement in the reliability and validity. The factor VDV 2 was removed due to low factor loading and further the removal of same enhanced the reliability and validity of the Lower Order Constructs.

II. **Multicollinearity:** The VIF values of the whole factors are <5.0, so the factors vendor scalability and vendor viability do not have any serious multicollinearity issues.

III. **Reliability:** The table no 5.8 also presents the result of construct reliability analysis (Cronbach's Alpha and Composite Reliability) of the Lower Order Constructs. The Cronbach's Alpha and Composite Reliability for vendor viability is 0.845 and 0.795 respectively and the Cronbach's Alpha and Composite Reliability for vendor scalability is 0.805 and o.884 respectively. The result shows the reliability statistic of both indicators are beyond the required threshold of 0.70 suggested by Hair et al., (2011). Hence Lower Order Constructs established the construct reliability.

IV. **Construct Validity** After interpreting the construct reliability, the study is trying to establish Construct Validity through Convergent Validity and Discriminant Validity

1. **Convergent Validity:** It can be established through AVE. Here, the AVE of vendor viability and vendor scalability is 0.513 and 0.718 respectively, hence there are no issues in the convergent validity as it is greater than the minimum limit of 0.05.

2. **Discriminant Validity:** the study examined the discriminant validity through Fornell -Larcker Criterion, Cross Loading, can be examined and HTMT Ratio

   a. **Fornell -Larcker Criterion**

Table 5.9

Fornell -Larcker Criterion: Vendor Efficiency Measurement Model

	VDS	VDV
VDS	***0.833***	
VDV	-0.161	***0.818***

As per the Fornell- Larcker criterion in table 5.9, the model does have discriminant validity among its factors because both factors have the highest value in their respective row and column. The square root of AVE (in Bold and Italics) for vendor scalability and vendor viability has higher values in the corresponding row and column (for vendor scalability, 0.833>-0.161 and for vendor viability, 0.818 > -0.161). Hence, it was found, no discriminant value issues regarding vendor scalability and vendor viability and discriminant validity is established.

a. Cross Loading:

Table 5.10

Cross Loading -Vendor Efficiency Measurement Model

	VDV	VDS
VDV1	***0.732***	-0.037
VDV3	***0.904***	-0.164
VDV4	***0.782***	-0.132
VDV5	***0.843***	-0.128
VDS1	-0.180	***0.928***
VDS2	-0110	***0.814***
VDS3	-0.044	***0.748***

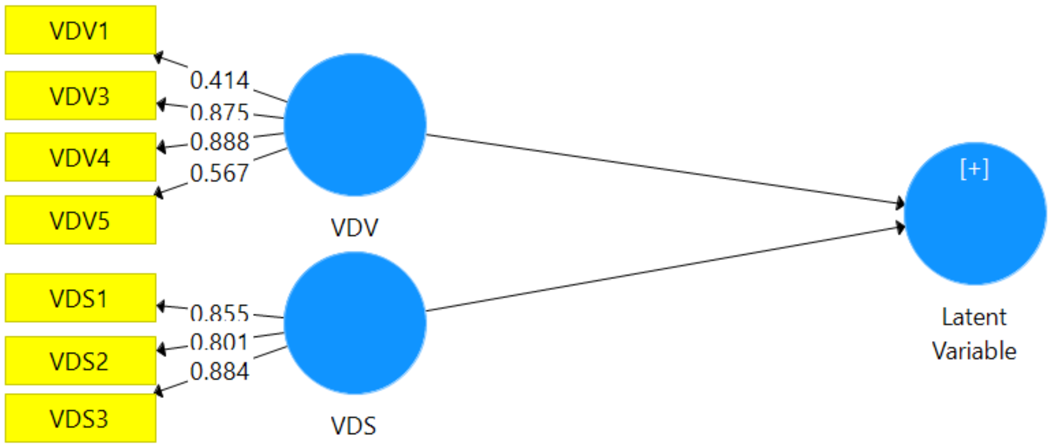
The items belong to vendor viability and items belong to vendor scalability loads strongly (numbers in bold and italics) on its underlying construct instead of other constructs in the study. Hence, discriminant validity is proven for vendor scalability and vendor viability based on cross loading evaluation presented in table 5.10.

b. **HTMT Ratio:** The ratio established the discriminant validity as the value is less than 0.90 for both vendor scalability and vendor viability

❖ **Vendor Efficiency Measurement Model:** The final Vendor Efficiency Measurement model is given in the following figure 5.1

Figure 5.1

Vendor Efficiency Measurement Model



B. CTE Measurement Model

Here CFA is used to assess the robustness of the two-factor model of consultant evaluation. CFA had carried out by using the software 'Smart PLS 3.0' in the following table 5.11

Table 5.11

Validity Indices - Consultant Evaluation Measurement Model

LOC and items	Factor Loadings	Indicator Multicollinearity (VIF)	Cronbach's Alpha	Composite Reliability	Convergent Validity (AVE)
Consultant Viability					
CTV1	0.889	2.927	0.792	0.866	0.622
CTV 3	0.720	1.393			
CTV 4	0.867	2.777			
CTV 5	0.655	1.308			
Consultant Scalability					
CTS1	0.898	2.124	0.835	0.901	0.751
CTS 2	0.826	1.813			
CTS 3	0.875	1.971			

I. **Factor Loading**: From table 5.11 CTV1, CTV3, CTV4, CTS1, CTS2 and CTS3 shows a factor loading more than the minimum criteria of 0.50, hence these factors have higher correlation. Even though the CTV5 shows a factor loading less than 0.50 which is insignificant, it is not considered for removal as the removal of these low loading indicators does not make any improvement in the reliability and validity. So, the factors consultant scalability and consultant viability as a whole show a high correlation. One item (CTV2) had removed after showing a low factor loading (<0.50) Hair et al., (2016) and the removal increased the validity of the Lower Order Constructs

II. **Multicollinearity:** The VIF values of the whole factors are >5.0, so the factors consultant scalability and consultant viability do not have any serious multicollinearity issues.

III. The table no 5.11 is also presents the result of construct reliability analysis (Cronbach's Alpha and Composite Reliability) of the Lower Order Constructs. The Cronbach's Alpha and Composite Reliability for consultant viability is 0.792 and 0.866 respectively and the Cronbach's Alpha and Composite Reliability for consultant scalability is 0.835 and 0.901 respectively. The result shows the reliability statistic of both indicators are beyond the required threshold of 0.70 suggested by Hair et al., (2011). Hence Lower Order Constructs established the construct reliability.

IV. **Construct Validity:** After interpreting the construct reliability, the study is trying to establish Construct Validity through Convergent Validity and Discriminant Validity

1. **Convergent Validity:** It can be established through AVE. Here, the AVE of consultant viability and Scalabilty is 0.622 and 0.751 respectively, hence there is no issues in the convergent validity as it is greater than the minimum limit of 0.05.

2. **Discriminant Validity:** The study examined the discriminant validity through Fornell -Larcker Criterion, Cross Loading, can be examined and HTMT Ratio

a. **Fornell -Larcker Criterion**

Table 5.12

Fornell -Larcker Criterion: consultant evaluation Measurement Model

	CTS	CTV
CTS	***0.867***	
CTV	0.517	***0.789***

As per the Fornell-Larcker criterion in table 5.12, the model does have discriminant validity among its factors because both factors have the highest value in their respective row and column. The square root of AVE (in Bold and Italics) for consultant viability has higher values in the corresponding row and column (for CTS**,** ***0.867***>-0.517 and for CTV, ***0.789***> 0.517). Hence, it was found, no discriminant value issues regarding consultant scalability and consultant viability, so the discriminant validity is established.

b. Cross Loading

Table 5.13

Cross Loading – Consultant Evaluation Measurement Model

	CTV	**CTS**
CTV1	***0.888***	0.417
CTV 3	***0.720***	0.432
CTV 4	***0.867***	0.402
CTV 5	***0.655***	0.398
CTS1	0.504	***0.898***
CTS 2	0.350	***0.826***
CTS 3	0.472	***0.875***

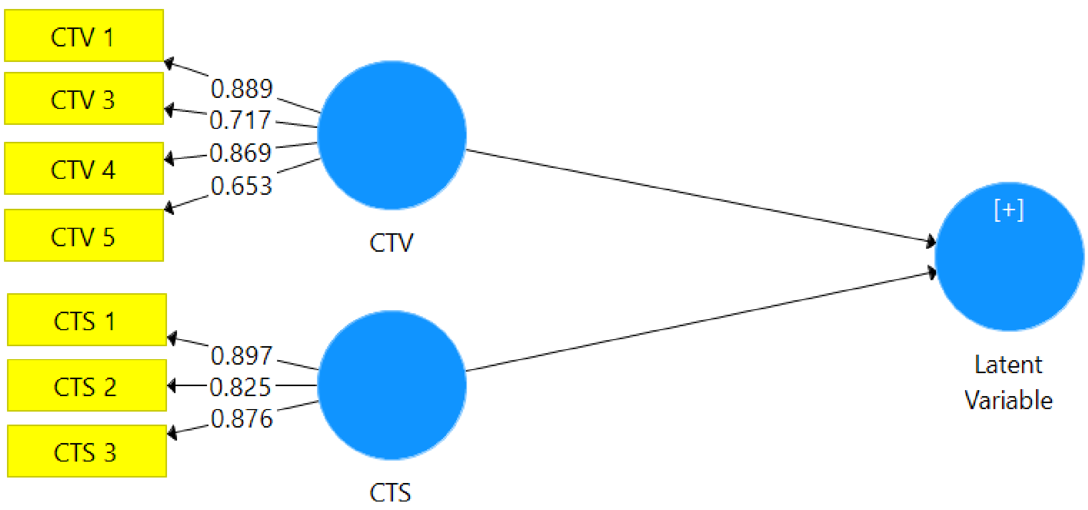
The items belong to consultant viability and items belong to consultant scalability loads strongly (numbers in bold and italics) on its underlying construct instead of other constructs in the study. Hence discriminant validity is proven for consultant scalability and consultant viability based on cross loading evaluation given in Table 5.13.

c. **HTMT Ratio:** The ratio established the discriminant validity as the value is 0.635 which is less than 0.90 for both consultant scalability and consultant viability.

❖ **Consultant Evaluation Measurement Model:** The following figure 5.2 indicates the final Consultant Evaluation Measurement Model

Figure 5.2

Consultant Evaluation Measurement Model



C. OGR Measurement Model

The study identified three factors to evaluate the efficiency in making the organisation ready to implement an ERP. The three factors are the resource mobilisation Business Process Reengineering and the end-user training. Here CFA is used to assess the robustness of the three-factor model of organisational readiness. CFA had carried out by using the software 'Smart PLS 3.0' in the following table 5.14

Table 5.14

Validity Indices – Organisational Readiness Measurement Model

LOC and items	Factor Loadings	Indicator Multicollinearity (VIF)	Cronbach's Alpha	Composite Reliability	Convergent Validity (AVE)
Business Process Reengineering					
BPR 2	0.698	1.577	0.872	0.905	0.657
BPR 3	0.751	1.760			
BPR 4	0.888	1.348			
BPR 5	0.888	1.707			
BPR 6	0.812	1.588			
End User Training					
EUT1	0.627	1.124	0.840	0.846	0.531
EUT 2	0.934	1.689			
EUT 3	0.718	1.609			
EUT4	0.716	1.652			
EUT5	0.599	2.417			
Resource Mobilisation					
RMO1	0.909	2.389	0.801	0.868	0.624
RMO2	0.744	1.684			
RMO3	0.718	1.642			
RMO4	0.774	1.660			

I. **Factor Loading**: From table 5.14, BPR2, BPR3, BPR4, BPR5, BPR6, EUT1, EUT2, EUT3, EUT4, EUT5, RMO1, RMO2, RMO3 and RMO4 shows a factor loading more than the minimum criteria of 0.50, hence these factors have higher correlation. So, the factors BPR, end-user training and resource mobilisation as a whole show a high correlation. The factor BPR 1 and RMO 5 had removed due to low factor loading and further the removal of same enhanced the reliability and validity of the Lower Order Constructs.

II. **Multicollinearity:** The VIF values of the whole factors are <5.0, so the factors BPR, end-user training and resource mobilisation do not have any serious multicollinearity issues.

III. **Reliability:** The table no 5.14 also presents the result of construct reliability analysis (Cronbach's Alpha and Composite Reliability) of the Lower Order Constructs. The Cronbach's Alpha and Composite Reliability for BPR is 0.872 and 0.905 respectively, the Cronbach's Alpha and Composite Reliability for end-user training is 0.840 and 0.846 respectively and it is 0.801 and 0.868 respectively for resource mobilisation. The result shows the reliability statistic of both indicators are beyond the required threshold of 0.70 suggested by Hair et al., (2011). Hence Lower Order Construct established the construct reliability. By including the factor EUT 6, the composite reliability of the Lower Order Constructs had reduced to 0.58, So the study removed the concerned item and makes the variable reliable and got a reliability more than 0.70.

IV. **Construct Validity:** After interpreting the construct reliability, the study is trying to establish Construct Validity through Convergent Validity and Discriminant Validity

1. **Convergent Validity:** It can be established through AVE. Here, the AVE of BPR, end-user training and resource mobilisation is 0.657, 0.531 and 0.624 respectively, hence there are no issues in the convergent validity as it is greater than the minimum limit of 0.05.

2. **Discriminant Validity:** The study examined the discriminant validity through Fornell -Larcker Criterion, Cross Loading, can be examined and HTMT Ratio

   a. **Fornell -Larcker Criterion:**

Table 5.15

Fornell -Larcker Criterion: Organisational Readiness Measurement Model

	BPR	EUT	RMO
BPR	***0.811***		
EUT	0.055	***0.729***	
RMO	-0.020	-0.126	***0.790***

As per the Fornell- Larcker criterion in table 5.15, the model does have discriminant validity among its factors because the three factors have the highest value in their respective row and column. The square root of AVE (in Bold and Italics) for BPR, end-user training and resource mobilisation have higher values in the corresponding row and column. Hence, the discriminant validity is established as there is no discriminant value issues regarding BPR. end-user training and resource mobilisation.

b. Cross Loading:

Table 5.16

Cross Loading – Organisational Readiness Measurement Model

	BPR	EUT	RMO
BPR 2	***0.698***	0.027	-0.019
BPR 3	***0.751***	0.120	-0.012
BPR 4	***0.888***	0.024	-0.039
BPR 5	***0.888***	0.024	-0.039
BPR 6	***0.812***	0.027	0.012
EUT1	-0.025	***0.627***	-0.060
EUT 2	0.049	***0.934***	-0.133
EUT 3	0.030	***0.718***	-0.031
EUT4	0.081	***0.716***	-0.106
EUT5	0.014	***0.599***	-0.037
RMO1	-0.022	-0.036	***0.909***
RMO2	-0.104	-0.210	***0.744***
RMO3	-0.038	-0.083	***0.718***
RMO4	0.072	-0.111	***0.774***

The items belong to BPR, end-user training and items belongs to resource mobilisation loads strongly (numbers in bold and italics) on its underlying construct instead of other constructs in the study. Hence discriminant validity is proven for BPR. end-user training and resource mobilisation based on cross loading evaluation given in the Table 5.16.

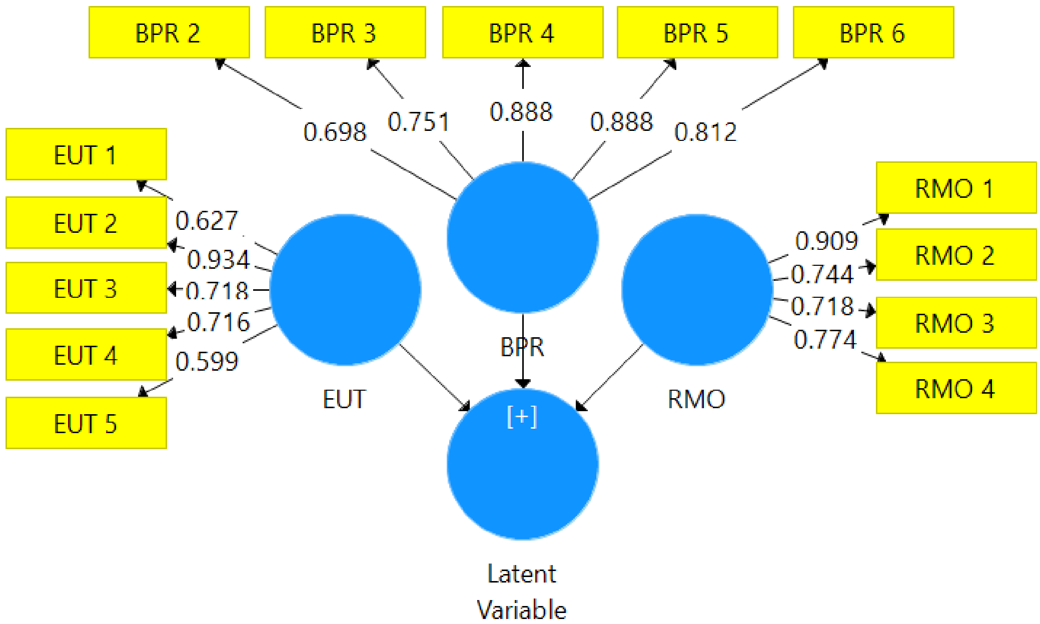
c. **HTMT Ratio:** The ratio established the discriminant validity as the HTMT ratios are less than 0.90.

❖ **Organisational Readiness Measurement Model**

The figure 5.3 demonstrates the Organisational Readiness Measurement Model

Figure 5.3

Organisational Readiness Measurement Model



D. ISR Measurement Model

The study identified three factors to evaluate the efficiency in information system readiness (ISR) to implement ERP. The three factors are the data migration (DMG), system testing (STG), and System Up gradation (STU). Here CFA is used to assess the robustness of the three-factor model of information system readiness. CFA had carried out by using the software 'Smart PLS 3.0' in the following table 5.17.

Table 5.17

Validity Indices – Information System Readiness Measurement Model

LOC and items	Factor Loadings	Indicator Multi-collinearity (VIF)	Cronbach's Alpha	Composite Reliability	Convergent Validity (AVE)
Data Migration					
DMG 1	0.755	1.668	0.788	0.861	0.608
DMG 2	0.773	1.526			
DMG 3	0.775	1.549			
DMG 4	0.815	1.653			
System Up gradation					
STU 1	0.773	1.965	0.855	0.896	0.632
STU 2	0.742	1.546			
STU 3	0.823	1.669			
STU 4	0.797	1.640			
STU 5	0.838	2.536			
System Testing					
STG 1	0.733	1.996	0.823	0.831	0.580
STG 2	0.708	1.583			
STG 3	0.780	1.370			
STG 5	0.729	1.901			
STG 6	0.851	2.557			

I. **Factor Loading**: From table 5.17, DMG1, DMG2, DMG3, DMG4, STU1, STU2, STU3, STU4, STU5, STG1, STG2, STG3, STG5 and STG6 shows a factor loading more than the minimum value of 0.50, hence these factors have higher correlation. So, the factors data migration, System Up gradation and system testing as a whole shows' high correlation. STG 4 was removed from the variable due to lack of factor loading and the removal of the same enhances the reliability and validity of the variable system testing.

II. Multicollinearity: The VIF values of the whole factors are <5.0, so the factors data migration, System Up gradation and system testing does not have any serious multicollinearity issues.

III. Reliability: The table no 5.17 also presents the result of construct reliability analysis (Cronbach's Alpha and Composite Reliability) of the Lower Order Constructs. The Cronbach's Alpha and Composite Reliability for data migration is 0.788 and 0.861 respectively, the Cronbach's Alpha and Composite Reliability for System Up gradation is 0.855 and 0.896 respectively and it is 0.823 and 0.831 respectively for system testing. The result shows the reliability statistic of the indicators are beyond the required threshold of 0.70 suggested by Hair et al., (2011). Hence Lower Order Constructs established the construct reliability.

IV. Construct Validity After interpreting the construct reliability, the study is required to establish Construct Validity through Convergent Validity and Discriminant Validity

1. Convergent Validity: It can be established through AVE. Here, the AVE data migration, System Up gradation and system testing is 0.608, 0.632 and 0.580 respectively, hence there are no issues in the convergent validity as it is greater than the minimum limit of 0.05.

The item DMG5 reflected a low reliability and validity as per the removal criteria. So both of the items were deleted to improve the reliability and validity above the required threshold.

3. **Discriminant Validity:** Fornell -Larcker Criterion, Cross Loading, can be examined and HTMT Ratio was used to establish the Discriminant Validity.

a. Fornell -Larcker Criterion

Table 5.18

Fornell -Larcker Criterion: Information System Readiness Measurement Model

	DMG	STU	STG
DMG	***0.780***		
STU	0.235	***0.795***	
STG	-0.140	-0.109	***0.762***

As per the Fornell-Larcker criterion in table 5.18, the model does have discriminant validity among its factors because the three factors have the highest value in their respective row and column. The square root of AVE (in Bold and Italics) for data migration, system upgradation and system testing have higher values in the corresponding row and column. Hence, the discriminant validity is established as there is no discriminant value issues regarding data migration, system upgradation and system testing.

b. Cross Loading

Table 5.19

Cross Loading – Information System Readiness Measurement Model

	DMG	STU	STG
DMG 1	***0.755***	-0.061	-0.039
DMG 2	***0.773***	-0.086	-0.160
DMG 3	***0.775***	-0.081	-0.010
DMG 4	***0.815***	-0.100	-0.111
STU 1	-0.099	***0.773***	0.012
STU 2	-0.039	***0.742***	-0.060
STU 3	-0.003	***0.823***	-0.133
STU 4	-0.132	***0.797***	-0.031
STU 5	-0.097	***0.838***	-0.106
STG 1	-0.033	-0.049	***0.733***

	DMG	STU	STG
STG 2	-0.022	-0.036	***0.708***
STG 3	-0.104	-0.210	***0.780***
STG 5	-0.038	-0.083	***0.729***
STG 6	0.072	-0.111	***0.851***

The items belong to data migration, system upgradation and system testing loads strongly (numbers in bold and italics) on its underlying construct instead of other constructs in the study. Hence discriminant validity is proven for data migration, system upgradation and system testing based on cross loading evaluation presented in Table 5.19.

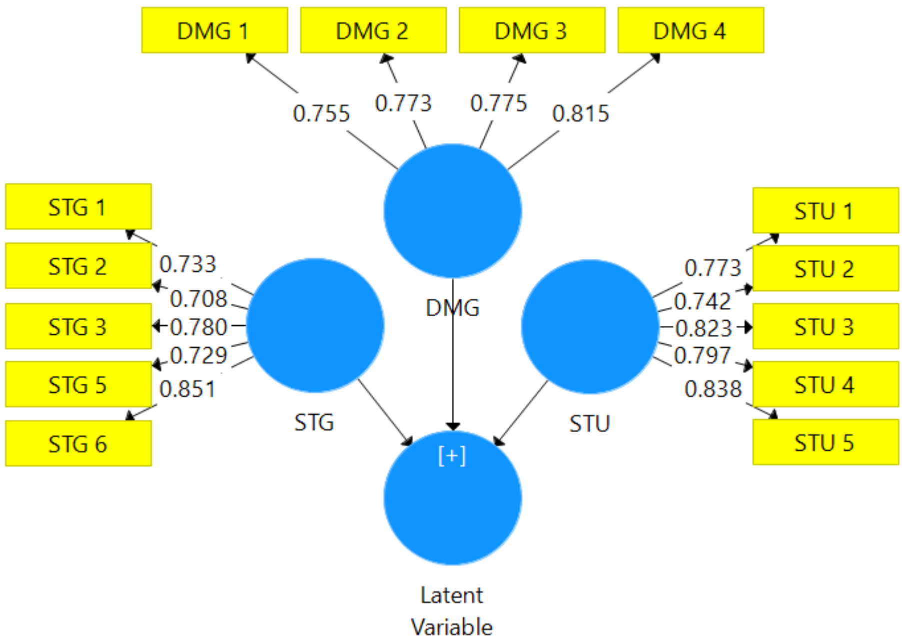
c. **HTMT Ratio** established the discriminant validity as the HTMT ratios are less than 0.90.

❖ **Information System Readiness Measurement Model**

The figure 5.4 demonstrates the Information System Readiness Measurement Model

Figure 5.4

Information System Readiness Measurement Model



Reliability and Validity Result Summary: Seven items were removed from the Lower Order Constructs due to lack of factor loading, validity and reliability. VDV2 had removed from the variable vendor evaluation, CTE2 from the variable consultant evaluation, BPR 1, RMO 5 from the variable organisational readiness and finally STG4 from the variable information system readiness had removed due to lack of factor loading and the removal enhanced the reliability and validity of the variable.

The item EUT6 under the variable organisational readiness had been removed due to reliability issues and finally the item DMG5 also removed, which has got both validity and reliability issues. The removal of all the above-mentioned items makes the final measurement models.

5.5 CSFs: Project Time and Project Cost

The study is required to analyse, whether the selected CSFs made any changes in the cost of the ERP implementation project and the duration of the project. For this the study formulated the hypotheses to test the significant difference in project time and Cost with the differences in the CSFs- functional scope, physical scope, vendor viability, vendor scalability, consultant viability, consultant scalability, resource mobilisation, BPR, end-user training, ERP Vendor, customisation level, consultancy services, implementation approaches, data migration and system testing.

5.5.1. Project Scope: Project Time and Project Cost

The segment revealed the result of the Kruskal Wallis test, which is used for the interpretation of variation in the time and cost of ERP implementation due to the differences in the physical scope and functional scope of ERP.

A. Functional Scope: Project Time and Project Cost

The functional scope of the organisation is explained in four different levels as per the modules adapted to provide assistance in the functions of the organisation. The organization decision regarding the implementation of ERP modules depends on the requirements of their business operation.

The hypotheses given below are formulated to test whether the differences in the ERP modules implemented make any differences in the duration and cost of ERP implementation.

H0: There is no significant difference in project time with the difference in functional scope.

H0: There is no significant difference in project cost with the difference in functional Scope.

Table 5.20

Differences: Functional Scope - Project Time and Project Cost (Kruskal Wallis test)

Dependent Variable	FNS	N	Mean Rank	Chi-Square	sig
PT	Level 0: Single Module	16	69.22	2.031	0.566
	Level 1: Core Modules	42	76.39		
	Level 2: Core Module + HR and/or PM	43	86.10		
	Level 3: Level 2 + All preceding levels	59	82.40		
	Total	160			
PC	Single Module	16	84.50	2.435	0.487
	Core Modules	42	78.6		
	Core Module + HR and/or PM	43	72.93		
	All Modules	59	86.67		
	Total	160			

The result in table 5.20 regarding the significant difference in the time and cost of ERP implementation due to the difference in functional scope reveals that there is no significant difference as. $\chi^2 = 2.031$, $p = 0.566$ ($p>0.05$), hence the study failed to reject both of the null hypothesis.

B. Physical Scope: Project Time and Project Cost

The organisations may implement the ERP software in their organisation premises or in a single branch or in a couple of branches or in the entire locations and also some organisations may have zero branches or a single branch or may be a couple of branches. The number of branches implemented ERP software may affect the time and cost of ERP implementation.

The following hypothesis is formulated to test the effect of difference in the number of ERP implemented branches on the duration and cost of ERP implementation

H0: There is no significant difference in project time with the difference in physical scope

H0: There is no significant difference in project cost with the difference in physical scope

Table 5.21

Differences: Physical Scope - Project Time and Project Cost

Dependent Variable	PHS	N	Mean Rank	Chi Square	Sig
PT	Zero Branches	13	85.96	2.216	.529
	1 to 10 Branches	81	76.99		
	11 to 20 Branches	46	79.57		
	Above 20 Branches	20	93.30		
	Total	160			
PC	Zero Branches	13	9.23	59.020	.000*
	1 to 10 Branches	81	70.06		
	11 to 20 Branches	46	102.21		
	Above 20 Branches	20	119.18		
	Total	160			

*Note: *significant at 5% significance level*

From the test result in the table 5.21, the study found that χ^2 =2.216, p>0.05, the study failed to reject the first null hypothesis. Hence, there is no significant difference in the duration of the project due to the difference in the number of ERP implemented branches of the selected manufacturing units.

But the test result is different while considering the cost of an ERP implementation project. χ^2 =59.020, P<.05 indicate that the study failed to reject the second null hypothesis. The study interprets from the above test result that the difference in the physical scope made a significant difference in the ERP implementation project cost.

Pairwise comparison is not possible in the Kruskal Wallis test. The test provided the p value for all the four groups. Hence, to nail down into two groups, to know the significant difference in the project cost with the difference in two different pair of ERP implemented branches, the study used post hoc Dunn test

Table 5.22

Pairwise Comparisons of Physical Scope (Project Time and Project Cost)

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
Zero Branche-1 to 10 branches	-60.831	13.829	-4.399	.000*
Zero Branche-11 to 20 branches	-92.976	14.539	-6.395	.000*
Zero Branche-Above 20 branches	-109.944	16.490	-6.667	.000*
1 to 10 branches – 11 to 20 branches	-32.145	8.545	-3.762	.000*
1 to 10 branches – Above 20 branches	-49.113	11.557	-4.250	.000*
11 to 20 branches – Above 20 branches	-16.968	12.397	-1.369	.171
Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .050.				

*Note: *significant at 5% significance level*

The table 5.22 is revealing a significant difference between all the pairs of number of branches except one. The pair with 11 to 20 branches and above 20 branches even make differences as per the mean rank, but it is not statistically significant as P>0.5. From the pairwise comparison, it was identified that the project cost of the organization with 11 to 20 ERP implemented branches is lesser while comparing to the organisations which have more than 20 ERP implemented branches, but it is not statistically significant as p>0.05. Thus, it can conclude that the increase the cost of an ERP implementation project is directly proportionate to the increase in the number of ERP implementation branches but there is no statistically significant difference in the project cost of ERP implemented organisations with 11 to 20 branches and more than 20 branches.

5.5.2 Vendor Evaluation: Project Time and Project Cost

In the pre implementation stage, the organisation is required to evaluate the vendor before the final selection of the vendor. The study used vendor viability and scalability as CSFs in evaluating the vendor efficiency. The efficiency of the vendor scalability and viability was examined above in Table 5.23 and 5.24, using quartiles. Here, the study is testing the differences in time and cost of ERP implementation due to differences in their efficiency in scalability and viability in managing the ERP system.

- **Vendor's Efficiency**

The study needs to know whether the organization has done a proper evaluation before selecting the ERP vendor. The evaluation must be done for the proper identification of the efficiency of the vendor. The organization examined the efficiency of vendor from the respondent's agreement to the statements regarding the vendor viability and vendor scalability while selecting the vendor.

After analyzing the efficiency, it had classified into Poor Efficient, Average Efficient and Highly Efficient using the quartiles and it is very significant to know whether there may be any differences in the project time and project cost when the vendor efficiency varies. The Kruskal Wallis statistic is used to test the association between vendor evaluation and the project time and project cost.

The table 5.23 categorized the responses using quartiles for identifying the levels of efficiency.

Table 5.23

Benchmark for determining the efficiency level of the Vendors

	Efficiency Level		
	Poor efficiency	**Average efficiency**	**High efficiency**
VDV	Below 12	12 to 18	Above 18
VDS	Below 9	9 to 14	Above 14

On the basis of the above classification in the table 5.23, the Vendor efficiency levels of the organization have been identified and provided in the following table 5.24.

Table 5.24

Vendor Efficiency Levels: Sample Frequency

	Sample Frequency		
	Poor efficiency	**Average efficiency**	**High efficiency**
VDV	35 (21.9%)	93 (58.1%)	32 (20%)
VDS	30 (18.8%)	63 (39.4%)	67 (41.9%)

From table 5.24 it was identified that 35 companies i.e., 21.9% of the respondents were acquired vendors with lower efficiency in viability followed by 93 (58.1%) and 32 (20%) respondents acquired vendors with average and high efficiency in viability.

In the case of vendor scalability, 30 (18.8%) companies acquired vendors having a low efficiency in scalability followed by 63 (39.4%) and 67 (41.9%) companies acquired vendors with average and highly efficient scalability.

After categorizing the efficiency of ERP vendor by evaluating their viability and scalability, the study is required to analyse the variations in project time and project cost due to the differences in the efficiency of vendors selected.

A. Vendor Viability: Project Time and Project Cost

This section of the study is analysing the differences in time and cost of ERP implementation due to variation in the efficiency in vendor viability.

The following hypotheses are formulated to test the differences in project time and project cost due to the differences in vendor viability.

H0: There is no significant difference in project time with difference in vendor viability.

H0: There is no significant difference in project cost with difference in vendor viability.

Table 5.25

Differences: Vendor Viability - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	VDV Efficiency Level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	32	85.38	3.447	0.178
	Average Efficiency	93	74.96		
	Poor Efficiency	35	90.77		
	Total	160			
PC	High Efficiency	32	109.91	16.874	0.000*
	Average Efficiency	93	78.84		
	Poor Efficiency	35	71.01		
	Total	160			

*Note: *significant at 5% significance level*

As χ^2=3.447, p=0.178 (P>0.05), the study failed to reject null hypothesis. This disclose that the difference in the vendor viability made no significant difference in the duration of the ERP implementation project.

The study failed to accept the second null hypothesis as the test result in the table 5.25 shows that $\chi^2 = 16.874$, P=0.000 ($p<0.05$). Hence, the difference in vendor viability made significant differences in the project cost.

The Kruskal Wallis test result indicates a significant difference in project cost with difference in vendor viability. As the test result shows a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the table 5.26.

Table 5.26

Pairwise Comparisons of vendor viability: project cost

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
3.000-2.000	-7.837	9.179	-.854	.393
3.000-1.000	31.063	11.321	2.744	.006*
2.000-1.000	38.901	9.486	4.101	.000*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

*Note: *significant at 5% significance level*

The table 5.26 is revealing a significant difference between two different pairs i.e., there is significant difference in the project cost while comparing to the organization having vendors with poor viability efficiency and high efficiency and also while comparing organization with average system viability efficiency and high efficiency as the $p<0.05$ Form the mean rank it is clearer that the cost is decreasing drastically in the low efficiency level and average efficiency level comparing to the mean rank of organization with higher efficiency but even there is differences in the pair with average and low efficiency, it is not statistically significant as $p>0.05$.

B. Vendor scalability: Project Time and Project Cost

In the vendor evaluation, it is very critical to evaluate the vendor scalability like vendor viability, that was done in the previous section. In this section the study needs to test the significant difference in project time and project cost with difference in the vendor efficiency in scalability of the new ERP system. For testing the significant differences, the study developed the following hypotheses.

H0: There is no significant difference in project time with differences in vendor scalability.

H0: There is no significant difference in project cost with differences in vendor scalability.

Table 5.27

Differences: vendor scalability - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	VDS efficiency level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	67	82.07	0.813	0.666
	Average Efficiency	63	82.09		
	Poor Efficiency	30	73.67		
	Total	160			
PC	High Efficiency	67	78.91	4.821	0.090
	Average Efficiency	63	74.48		
	Poor Efficiency	30	96.70		
	Total	160			

The test result in table 5.27 is done to prove whether the differences in the vendor scalability efficiency made any difference in the project time and project cost and it was found that χ^2 (3) =0.813, P=0.666 (p>0.05) regarding project time and χ^2 (3) =4.821, P=0.090 (p>0.05), regarding project cost, the study failed to reject both of the null hypothesis. Thus, it can interpret that there is no significant difference in both the time of completion of the project and its cost due to the difference in the vendor scalability efficiency.

5.5.3 Consultant Evaluation: Project Time and Project Cost

The study is required to analyse whether the organization was done a proper evaluation of the consultant before opting their services to assist the implementation of ERP system. The evaluation must be done for the proper identification of an efficient consultant. Only 128 samples were considered for this analysis as these are the firms which utilized the consultancy services for ERP implementation. The study examined the efficiency from the respondent's agreement to the statements regarding the consultant viability and consultant scalability before selecting the Consultant.

- **Consultants' Efficiency**

The study classifies the efficiency into Poor Efficiency, Average Efficiency and High Efficiency using the quartiles and it is very significant to know whether there may be any differences in the project time and project cost when the consultant viability and consultant scalability varies from organization to organization.

The table 5.28 categorized the responses using quartiles for identifying the levels of efficiency.

Table 5.28

Benchmark for determining the efficiency levels

	Efficiency Level		
	Poor efficiency	Average efficiency	High efficiency
CTV	Below 13	13 to 17	Above 17
CTS	Below 10	10 to 12	Above 12

On the basis of the above classification, the Consultant efficiency levels of the organization have been identified and provided in the following table 5.29.

Table 5.29

Consultant Efficiency Levels: Sample Frequency

	Sample Frequency		
	Poor Efficiency	**Average efficiency**	**High efficiency**
CTV	50 (39.06%)	36 (28.10%)	42 (32.81%)
CTS	55 (42.97%)	34 (26.56%)	39 (30.47%)

From the table 5.29, it was identified that 50 companies i.e., 39.06% of the respondents were adopted the consultant having a low efficiency regarding the system Viability followed by 36 (28.13%) respondents having average efficiency and 42 (32.81%) companies are highly efficient.

In the case of Scalability of the consultants, 55 (42.97%) companies are showing a lower efficiency in system scalability but 34 (26.56%) are showing an average efficiency and remaining 39 (30.47%) are highly efficient.

A. Consultant Viability: Project Time and Project Cost

This section of the study is analysing the differences in time and cost of ERP implementation due to the differences in the consultant viability.

The following hypotheses are formulated and tested to identify the significant difference in the duration of an ERP implementation project and the cost involved in it as a result of the difference in the efficiency of the viability of ERP consultant.

H0: There is no significant difference in project time with the differences in consultant viability

H0: There is no significant difference in project cost with the differences in consultant viability

Table 5.30

Differences: consultant Viability - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	CTV Efficiency Level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	42	71.17	5.181	0.075
	Average Efficiency	36	90.38		
	Poor Efficiency	50	81.34		
	Total	128			
PC	High Efficiency	42	87.33	8.350	0.015*
	Average Efficiency	36	85.99		
	Poor Efficiency	50	62.51		
	Total	128			

*Note: *significant at 5% significance level*

From the two H0 formulated in this section, the study failed to reject the first hypothesis as χ^2 =5.181, P=0.075 (p>0.05) so, it can conclude that there is no statistically significant difference in the duration of implementing ERP system as result of the difference in the consultant viability. But the study found that χ^2 = 8.350, P=0.015 (p<0.05), hence the study failed to accept the null hypothesis. Thus, the test result indicates that there is statistically significant difference in the cost of implementing the ERP system with the differences in the consultant viability.

The study made a pairwise comparison below to find the significant difference in two different pairs using Dunn test in the following table.

Table 5.31

Pairwise Comparisons of consultant Viability and project cost

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
3.000-2.000	23.479	9.514	2.468	.014*
3.000-1.000	24.813	9.288	2.672	.008*
2.000-1.000	1.334	8.501	.157	.875

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

*Note: *significant at 5% significance level*

The table 5.31 reveals a significant difference in the project cost among the organization having consultants with poor and average viability efficiency and among the organisations having consultant with poor and high viability efficiency as the $p < 0.05$ in both combinations. From the mean rank in table 5.30 it is clear that the cost of ERP implementation increases as the consultant viability efficiency increases and vice versa.

B. Consultant Scalability: Project Time and Project Cost

The scalability of the consultant is essential to make changes if required. This part of the chapter analyses the differences in the project time and project cost due to the differences in the efficiency of consultant scalability. The study developed the following hypotheses and tested them to identify the significant difference in the project cost and project time.

H0: There is no significant difference in the project time with the differences in the consultant scalability.

H0: There is no significant difference in the project cost with the differences in the consultant scalability.

Table 5.32

Differences: Consultant Scalability - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	CTS efficiency level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	39	87.93	2.770	0.250
	Average Efficiency	34	80.23		
	Poor Efficiency	55	73.32		
	Total	128			
PC	High Efficiency	39	76.86	4.821	0.090
	Average Efficiency	34	81.56		
	Poor Efficiency	55	83.17		
	Total	128			

After testing the developed hypotheses, the study found in the table 5.32 that $p>0.05$ regarding project time and cost. Hence, the study failed to reject both of the null hypothesis. Thus, it can interpret that there is no significant difference in the duration of ERP implementation and cost of ERP implementation with the difference in the efficiency level of the consultant scalability as the p value of both the hypothesis test result is greater than 0.05.

5.5.4 Software Readiness (SWR): Project Time and Project Cost

Before implementing the ERP system, the organsiation is required to decide the vendors from which the ERP system should purchase after evaluating their efficiency. The organisation also need to take decisions regarding the adoption or non-adoption of consultancy services evaluating their efficiency and other factor to be considered is the level of customization. The level of customization depends on the requirements of the organisation and the ability of the vendor to customize the software as per the business requirements. The below section of the study tests the differences in the selection of these factors may make any variations in the project time and cost.

A. ERP Package Vendor (EPV): Project Time and Project Cost

The leading vendor of ERP is SAP (Panorama, 2019), which is categorized into a group, and the remaining vendors into another category. From this classification the study classified the ERP providers into two categories as per their position in the ERP market, so as to check the whether the difference in selection of vendor by different organisations will make any variations in the duration of the implementation and the cost incurred for implementing ERP software. The following hypotheses are formulated and tested to find the differences.

H0: There is no significant difference in the project time with the differences in ERP Package Vendor

H0: There is no significant difference in the project cost with the differences in ERP Package Vendor.

Table 5.33

Differences: ERP Package Vendor – Project Time and Project Cost(Mann Whitney U test)

	Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
	SAP	120	83.56	2032.500	2852.500	-1.457	0.145
PT	Others	40	71.31				
	Total	160					
	SAP	120	83.05	2093.500	2913.500	-1.209	0.227
PC	Others	40	72.84				
	Total	160					

Table 5.33 provides the U statistic, and the asymptotic significance (2 tailed) P-value. It is observed that p-value >0.05 (U=2032.500, z=-1.457, p=0.145) regarding project time and p-value >0.05 (U = 2093.500, z = -1.209, p = 0.227) regarding project cost. As p>0.05 in both tests, the study failed to reject both of the null hypothesis. Thus, the study identified that the difference in the ERP Package Vendor for the project made no significant difference in project time and Cost.

B. Customisation Level (CTL): Project Time and Project Cost

Often ERP system required to modify the existing codes or to create new codes which is suitable for the functionality of the organization, which may not be available with the ERP system planned for the implementation. From the available data it is observed that customization falls within the significant level i.e., within 50% code modification. None of the samples showed extreme customization i.e., over 50% of code modification and none of the samples have been used a completely customized or in house developed or best of breed ERP solutions. The customisation level had classified into four levels as per the specific requirements of different organisations.

Here, Kruskal allis test is used to check the significant difference s in project time and project cost when the customization level opted by different organization differs. The following hypothesis are formulated and tested to identify the significant differences in the project time and project cost with the differences in the customisation level.

H0: There is no significant difference in project time with the difference in customisation level.

H0: There is no significant difference in project cost with the difference in customisation level.

Table 5.34

Differences: Customisation Level - Project Time and Project Cost

	Cutomisation Level	N	Mean Rank	Chi Square	p-value
PT	Zero Customisation	49	73.61	2.620	0.454
	Minor customisation (1 to 10%)	34	74.25		
	Moderate Customisation (11-25%)	46	81.90		
	Major Customisation (26-50%)	31	87.88		
	Total	160			

	Cutomisation Level	N	Mean Rank	Chi Square	p-value
PC	Zero Customisation	49	35.97	44.085	0.000*
	Minor customisation (1 to 10%)	34	83.04		
	Moderate Customisation (11-25%)	46	83.62		
	Major Customisation (26-50%)	31	113.85		
	Total	160			

*Note: *significant at 5% significance level*

It is observed in the table 5.34 that the study failed to reject the null hypothesis as χ^2=2.620, P=**0.454**(p>0.05). Hence, the difference in the customisation level for the project is not making any significant difference in project time.

Regarding the cost of the project, the χ^2 =44.085, P=**0.000** (p<0.05), hence the study failed to accept the null hypothesis and concluded that the difference in the level of customization made a significant difference in the cost of implementing the new ERP system. As the Kruskal Wallis test result is showing a significant difference, the study made a pairwise comparison of the different customisation level in the table 5.35.

Table 5.35

Pairwise Comparisons of Project Cost and Customisation Level

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
Zero customisation-Moderate Customisation (11-25%)	-45.130	10.756	-4.196	.000*
Zero customisation-Minor Customisation (1-10%)	-47.076	11.494	-4.096	.000*
Zero customisation- Major Customisation (26-50%)	-70.379	10.622	-6.626	.000*
Moderate Customisation (11-25%)-Minor Customisation (1-10%)	1.946	10.468	.186	.853
Minor Customisation (1-10%)-Major Customisation (26-50%)	-25.249	9.502	-2.657	.008*
Moderate Customisation (11-25%)- Major Customisation (26-50%)	-23.303	10.331	-2.256	.024*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

*Note: *significant at 5% significance level*

From the mean rank in table no 5.34 it was found that the cost of the project increases as customisation level. But from the pair wise comparison, the study found that even there is difference in the cost of ERP implementation with the differences in the customisation level, five pair of customisation level showed a significant difference in the project cost.

C. Consultancy services (CNTS): Project Time and Project Cost

It is the option of the organisations to adopt the Consultancy services or not. Some organisations use their own IT strength to assist in the ERP implementation. Some may select an external consultant for the implementation. This section is used to check whether there is any significant difference in the project time and project cost, with adopting Consultancy services and without the services.

The following hypotheses are developed and tested to find the differences.

H0: There is no significant difference in the project time with the adoption of Consultancy services.

H0: There is no significant difference in the project cost with the adoption of Consultancy services.

Table 5.36

Differences: Consultancy services - Project Time and Project Cost

	Consultant Services	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
PT	Adopted	128	80.38	2302.000	10288.000	0.069	0.945
	Not Adopted	32	81.00				
	Total	160					
PC	Adopted	128	86.63	1263.500	1791.500	3.350	0.001*
	Not Adopted	32	55.98				
	Total	160					

*Note: *significant at 5% significance level*

From the table 5.36 it is observed that, as p-value > 0.05 (U=2032.500, z=0.069, p=0.945), the study failed to reject the null hypothesis. Hence, the adoption and not adoption of Consultancy services for the ERP implementation made no statistically significant difference in the duration of ERP implementation.

It is also observed that, since p-value <0.05 (U=1263.500, z=3.350, p=0.001) and the test c 'z' doesn't fall within the critical values z-1.96 and +1.96, the study failed to accept the null hypothesis. Thus, the study found that the adoption and not adoption of Consultancy services for the ERP implementation made a statistically significant difference in the cost of the ERP implementation project.

The result indicates that there is a difference in the project cost between the organization which adopted and not adopted the service of the ERP consultant. The Mean Rank provided in the test result indicates that the project cost is higher in the enterprises where they used the Consultancy services and it is low in case of the organisation which avoided the service of the consultant.

D. Implementation Approaches (IMPA): Project Time and Project Cost

There are different ways adopted by the organization for the implementation of ERP system. The study classified the implementation approaches into three as per the data received from the samples selected. This section is used to check whether there is any difference in the project time and project cost, with the changes in the implementation approaches adopted by the organisations.

The following hypothesis was formulated and tested to check the significant difference between the difference in the implementation approaches and the project time and project cost. Here, Kruskal Wallis Test is used to analyse the differences.

H0: There is no significant difference in the project time with the differences in implementation approaches.

H0: There is no significant difference in the project cost with the differences in implementation approaches.

Table 5.37

Differences: Implementation Approaches – Project Time and Project Cost

	Implementation approaches	N	Mean Rank	Chi Square	p-value
PT	Big bang	94	76.03	6.273	0.043*
	Module wise	50	80.36		
	Roll out	16	107.22		
	Total	160			
PC	Big bang	94	77.13	1.489	0.475
	Module wise	50	83.60		
	Roll out	16	90.63		
	Total	160			

*Note: *significant at 5% significance level*

Table 5.37 provides the mean rank, and the asymptotic significance (2 tailed) P-value. It is observed that as $\chi^2 = 6.273$, p-value = 0.043 ($p <\alpha\ 0.05$), the study failed to accept the null hypothesis. The difference in the implementation approaches and the changes in the project time were statistically significant. But in case of cost of implementation, the study failed to reject the null hypothesis as □**2** (3) =1.489, $p>0.05$. The Kruskal-Wallis test discloses the difference in the implementation approaches and the difference in the project cost were not significant.

As the data is providing the result on the existence of statistical difference in the project time associated with the differences in the implementation approaches, it is relevant to carry out a pairwise comparison, which is exhibited in the following table 5.38.

Table 5.38

Pairwise Comparisons of Project Time and Implementation Approaches

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
BigBang-ModuleWise	-4.333	8.061	-.538	.591
BigBang-RollOut	-31.192	12.455	-2.504	.012*
Module-RollOut	-26.859	13.228	2.030	.042*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

*Note: *significant at 5% significance level*

From the Mean Rank provided in the Kruskal Wallis test result in table no 5.37 the study interprets that the duration is higher in the enterprises where they adopted the rollout approach followed by module wise approach and big bang. Even there is a difference in the duration of ERP implementation with the differences in implementation approaches as per the mean rank, the pairwise comparison results in the table 5.38 is highlighting a statistically significant difference in the time of implementing the ERP between the organization adopted the big bang approach and branch wise roll out of ERP, module wise approach and branch wise roll-out as $p<0.05$.

5.5.5 Organisational Readiness: Project Time and Project Cost

For implementing the ERP project, the organisation should be efficient enough to mobilise the resources required for the implementation, there need efficiency in changing the existing business operation processes to make a balance with the ERP system and also, they must prepare the users of the organisation to operate the new system. The following analysis was done to test, whether the differences in efficiency in managing the factors like resource mobilisation, BPR, end-user training for preparing the organisation may make any variations on the project time and the project cost. The level of resource mobilisation, BPR and end-user training efficiency was identified in table 5.39 and 5.40 using quartiles and frequencies.

- **Organisational Readiness Efficiency**

Table 5.39 categorized the responses using quartiles for identifying the levels of efficiency.

Table 5.39

Benchmark for determining the Organisational Readiness Efficiency Levels

	Efficiency Level		
	Poor Efficiency	**Average efficiency**	**High efficiency**
Efficiency in RMO	Below 16	16 to 18	Above 18
Efficiency in BPR	Below 22	22 to 24	Above 24
Efficiency in EUT	Below 19	19 to 20	Above 20

On the basis of the above classification in table 5.39, the study identified the sample frequency under each level of efficiency in the following table.

Table 5.40

Organisational Readiness Efficiency Levels: Sample Frequency

	Poor Efficiency	**Average efficiency**	**High efficiency**
Efficiency in RMO	49 (30.6%)	49 (30.6%)	62 (38.8%)
Efficiency in BPR	40 (25.0%)	76 (47.5%)	44 (27.5%)
Efficiency in EUT	40 (25.0%)	50 (31.3%)	70 (43.8%)

From the table 5.40 it was identified that 49 companies i.e., 30.6% of the respondents had revealed a poor efficiency in resource mobilisation and 49 (30.6%) respondents are showing an average efficiency and finally 62 (38.8%) companies are highly efficient.

In the case of the efficiency of the organisations in BPR, 40 (25.0%) companies are showing a poor efficiency and 76 (47.5%%) are showing an average efficiency and remaining 44 (27.5%) are highly efficient. 40 companies i.e., about 25,0% of the total sample shows less efficiency in providing end-user training. Of the remaining companies 50 companies and 70 companies i.e., about 31.3% and 70% show an average efficiency and higher respectively.

A. Resource Mobilisation: Project Time and Project Cost

Efficiency in mobilizing the required resources is an important and critical factor in the process of ERP implementation. This difference in the level of efficiency between organisations makes a difference in the time of completion of ERP project and its cost. The study developed and tested the following hypotheses to test the significant differences in the project time and project cost between organisations due to the difference in their resource mobilisation.

H0: There is no significant difference in project time with the difference in resource mobilisation efficiency.

H0: There is no significant difference in project cost with the difference in resource mobilisation efficiency.

Table 5.41

Differences: Resource Mobilisation – Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	RMO efficiency level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	62	80.25	0.722	0.697
	Average Efficiency	49	84.60		
	Poor Efficiency	49	76.71		
	Total	160			
PC	High Efficiency	62	75.60	2.978	0.226
	Average Efficiency	49	77.24		
	Poor Efficiency	49	89.95		
	Total	160			

After testing both of the hypotheses the study found that χ^2 =0.722, P=0.697(p>0.05) in the case of project time and χ^2 =2.978, 0.226 (p>0.05) regarding project cost, the study failed to reject both of the null hypothesis. Therefore, there is no significant difference in the time of implementing ERP and the cost of its implementation as a result of the differences in the efficiency in mobilizing resources.

B. Business Process Reengineering (BPR): Project Time and Project Cost

Sometime, the organization is required to reframe its business operation. But there may be inefficiency in its process and some organizations show a high efficiency in it. The difference in the efficiency in reengineering the business process makes a difference in the ERP implementation project time and its cost. This part of the study is trying to identify the significant difference in the project time and project cost as a result of the variations in the level of efficiency in BPR by developing and testing the following two hypotheses.

H0: There is no significant difference in the project time with the differences in Business Process Reengineering efficiency.

H0: There is no significant difference in the project cost with the differences in Business Process Reengineering efficiency.

Table 5.42

Differences: BPR - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	BPR Efficiency Level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	44	79.24	0.077	0.962
	Average Efficiency	76	81.53		
	Poor Efficiency	40	79.94		
	Total	160			
PC	High Efficiency	44	82.47	3.802	0.149
	Average Efficiency	76	73.76		
	Poor Efficiency	40	91.94		
	Total	160			

The study rejected both of the above formulated null hypothesis as the $p>0.05$ after testing the hypothesis. So, it can conclude that the differences in the efficiency of mobilizing resources made no significant difference in the time of ERP implementation and its cost.

C. End-User Training (EUT): Project Time and Project Cost

Human resources are the factor which is giving life to the ERP system. So, it is essential to provide enough training for the users of ERP systems. Otherwise, the entire system will collapse. Along with the process of ERP implementation, the organization should take utmost care in providing efficient end-user training. Because sometime the inefficiency in training programs affects even the system testing before going live. This makes the delay in ERP implementation and sometimes increases the implementation cost. To test whether the differences in the end-user training efficiency level made any difference between the time of the project and the cost. The study developed the following two hypotheses.

H0: There is no significant difference in the project time with the differences in end-user training efficiency.

H0: There is no significant difference in the project cost with the differences in end-user training efficiency.

Table 5.43

Differences End-User Training – Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	Efficiency Level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	70	80.30	0.043	0.979
	Average Efficiency	50	79.78		
	Poor Efficiency	40	81.75		
	Total	160			
PC	High Efficiency	70	106.36	18.316	0.000*
	Average Efficiency	50	78.33		
	Poor Efficiency	40	67.27		
	Total	160	67.27		

*Note: *significant at 5% significance level*

The first test in the table 5.43 was done to identify whether the differences in the efficiency level in end-user training made any difference in the project time and it was found that $\chi^2 = 0.043$, $P=0.979$ ($p>0.05$), there is no evidence to reject H0. Hence, there is no significant difference in the project time due to the difference in the training efficiency. But the study failed to accept the second H0 as the test revealed that $\chi^2 = 18.316$, $P=0.000$ ($p<0.05$), Hence, there exists a significant difference in the project cost with the differences in the efficiency level of end-user training. As the test result shows a significant difference in project cost, it is relevant to carry out a pair wise comparison, which is exhibited in the following table 5.44.

Table 5.44

Pairwise Comparisons of Project Cost and End-User Training

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
1.000-2.000	-11.059	8.571	-1.290	.197
1.000-3.000	-39.091	9.174	-4.261	.000*
2.000-3.000	-28.032	9.819	-2.855	.004*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

*Note: *significant at 5% significance level*

The pairwise comparison shows a significant difference in the cost of the project between the organisations with poor efficiency in providing end-user training and the organisations with high efficiency in it. The result is also showing the significant difference between the organization which provided an average efficient training program and the organisations with poor efficiency. In both cases the p value is less than 0.05. From the mean rank in the table 5.44. The study identified that the cost of ERP implementation increases as efficiency of training increases and vice versa. But the pairwise comparison highlights a significant difference only in between two pairs.

5.5.6 Information System Readiness (ISR): Project Time and Project Cost

After going through the different ERP implementation processes, the organization should ensure the efficiency of the entire system to make the implementation a successful one. Data migration and System testing are significant CSFs in making the Information system ready for going live. Sometimes organisations may not be so efficient in managing the data, especially in the process of data migration and also some organizations faced many failures while testing the new ERP system before going live. This may make additional cost and time to rectify the issues. This section of the chapter focused on such changes in the cost and time of implementing an ERP system due to the differences in the efficiency in data migration and system testing.

- **Information System Readiness efficiency**

The study used quartiles to classify the efficiency in the IS readiness activities of the organization. The table categorized the responses using quartiles for identifying the levels of efficiency.

Table 5.45

Benchmark for determining the Information System Readiness Efficiency Levels

	Efficiency Level		
ISR Efficiency	**Poor efficiency**	**Average efficiency**	**High efficiency**
Efficiency in DMG	Below 18	18 to 19	Above 19
Efficiency in STG	Below 22	22 to 24	Above 24
Efficiency in STU	Below 22	22 to 24	Above 24

Source: Primary Data

On the basis of the above classification in the table 5.45, the study identified the sample frequency under each level of efficiency in the following table 5.46.

Table 5.46

Information System Readiness Efficiency Levels: Sample Frequency

	Poor efficiency	**Average efficiency**	**High efficiency**
Efficiency in DMG	43 (26.9%)	68 (42.5%)	49 (30.6%)
Efficiency in STG	43 (26.9%)	67 (41.9%)	50 (31.3%)
Efficiency in STU	40 (25.0%)	76 (47.5%)	44 (27.5%)

Source: Primary Data

From the table 5.46 it had identified that 43 companies, i.e., 26.9%, had revealed a lower efficiency in data migration process and 68 (42.5%) companies had average efficiency and finally 49 (30.6%) companies had high efficiency in migrating the legacy system into the ERP system.

In the case of the efficiency of the organisations in system testing, 43 (26.9%%) companies showed lower efficiency, 67 (41.9%%) showed average efficiency and remaining 50 (31.3%%) companies showed high efficiency in system testing.

40 companies i.e., about 25.0% of the sample showed poor efficiency in system upgradation, and from the remaining companies 76 companies and 44 companies i.e., about 47.5% and 27.5% showed an average efficiency and high efficiency respectively.

A. Data Migration (DMG): Project Time and Project Cost

The migration of data from the existing ERP system is a much more complicated and time-consuming task. Inefficiency in transferring data can cause huge loss to the organization and sometimes lead to the ERP implementation failure. The study required to identify whether the dissimilarities among the organizations in the efficiency of migrating data made any differences in the ERP implementation phase and the cost of implementation. For analysing such differences, the study formulated and tested the following hypotheses.

H0: There is no significant difference in the project time with the differences in data migration efficiency.

H0: There is no significant difference in the project cost with the differences in data migration efficiency.

Table 5.47

Differences: Data Migration - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	Efficiency Level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	49	79.74	0.299	0.861
	Average Efficiency	68	78.99		
	Poor Efficiency	43	83.74		
	Total	160			
PC	High Efficiency	49	78.49	0.142	0.932
	Average Efficiency	68	81.07		
	Poor Efficiency	43	81.90		
	Total	160			

From the Kruskal Wallis test result in the table 5.47, the study identified that as χ^2 =0.299, P=0.861 ($p>0.05$) regarding project time and χ^2=0.142, 0.932 ($p>0.05$) regarding project cost, the study failed to reject both of the null hypotheses. Hence, there is no significant difference in project cost and project time with the difference in the efficiency in migrating data to the new ERP system and ERP system testing.

B. System Testing (STG): Project Time and Project Cost

The organization should be efficient enough to make the system testing effective. Then only they can correct any deviations from their expectations. The inefficiency in system testing makes the organization redo the entire process and it may take more time and money. This section focuses on identifying the changes in the implementation time and its cost due to the differences in the efficiency in system testing. The following hypotheses are formulated to test the difference in project cost and project time because of the variations in BPR efficiency.

H0: There is no significant difference in project time with the differences in system testing efficiency.

H0: There is no significant difference in project cost with the differences in system testing efficiency.

Table 5.48

Differences: System Testing - Project Time and Project Cost (Kruskal Wallis Statistic)

Dependent Variable	Efficiency Level	N	Mean Rank	Chi square	p-value
PT	High Efficiency	50	77.41	0.494	0.781
	Average Efficiency	67	80.47		
	Poor Efficiency	43	84.14		
	Total	160			
PC	High Efficiency	50	56.36	7.303	0.000*
	Average Efficiency	67	88.84		
	Poor Efficiency	43	95.58		
	Total	160			

*Note: *significant at 5% significance level*

The test result in the table 5.48 that the differences in the efficiency level in testing the new ERP system made an insignificant difference in the duration of ERP implementation as χ^2 =0.494, P=0.781 (p>0.05), hence there is not enough evidence to reject the null hypothesis. The second test result implies that there is a significant difference in the project cost with the difference in the system testing efficiency as project cost χ^2 = 7.303, P=0.000 (p<0.05), therefore the study failed to accept the H0. As the test result shows a significant difference in the cost of the project, the study made a pairwise comparison in the table 5.49 to know the significant difference between two pairs of organisations with two different efficiency levels.

Table 5.49

Pairwise Comparisons of Project Cost and System Testing

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
1.000-2.000	-32,476	8.647	-3.756	.000*
1.000-3.000	-39.221	9.624	-4.076	.000*
2.000-3.000	-6.746	9.042	-.746	.456

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

*Note: *significant at 5% significance level*

The mean rank generated from the Kruskal Wallis test indicates that the cost of an ERP implementation project increases as system testing efficiency decreases. But from the pairwise comparison in the table 5.49, the study found that there is a significant difference in the project cost between the organization which is highly efficient in system testing and the organization having average efficiency in it as $p<0.05$. Like that the organization with high system testing efficiency and poor efficiency is also showing a significant difference in the cost of the project as $p<0.05$.

5.6 Impact of ERP implementation on Project Time and Project Cost

The previous section of the chapter analysed the significant role of CSFs in the ERP implementation project time and Cost. Here, this section of the chapter tried to analyse the impact of CSFs on the project time and Cost, the impact of difference in the project time on the project cost by taking the project time as Mediation Variable.

5.6.1 Relationship between Project Time and Project Cost

As the metric data regarding project time and project cost lacks normality, it failed to meet the criteria of skewness and kurtosis and as the data is in ordinal scale, the study used nonparametric Spearman correlation test, to identify the correlation between project time and project cost. The study set the following hypothesis and tested it to identify if there is any significant relation between project time and project cost.

H0: There is no significant relationship between ERP implementation project time and ERP implementation project cost.

Table 5.50

Spearman Correlation Analysis - Project Time and Project Cost

	PT	**PC**
PT	1	
PC	0.764*	1
N	160	160

*Note: * Correlation is significant at the 0.05 level (2-tailed)*
Source: Primary Data

Spearman correlation of project time and project cost was found to be highly positive and statistically significant ($r = 0.764$, $p<0.05$). Hence the study failed to accept the null hypothesis. This shows that an increase in ERP implementation project time would lead to a higher ERP implementation project cost.

5.6.2 ERP implementation impact on the Project Time and Project Cost (PLS-Structural Equation Modelling)

The proposed research hypotheses below are tested to check the significant relationship using PLS SEM. The metric and quasi metric data along with the categorical data need to analyse in different ways. Otherwise, it will alter the interpretation (Ringle et al., 2005). Hence metric data and categorical data were analysed in two different ways and interpreted thereafter.

To know the impact of CSFs on project time, the study tested the hypotheses given below using PLS-SEM

H0: There is no significant impact of vendor evaluation on project time.

H0: There is no significant impact of consultant evaluation on project time.

H0: There is no significant impact of information system readiness on project time.

H0: There is no significant impact of organisational readiness on project time.

H0: There is no significant impact of consultancy services on project time.

H0: There is no significant impact of customisation level on project time.

H0: There is no significant impact of implementation approaches on project time.

H0: There is no significant impact of ERP vendors on project time.

H0: There is no significant impact of physical scope on project time.

H0: There is no significant impact of functional scope on project time.

The hypothesized path in the framework of the research can be highlighted through structural equation modeling. The assessment in the Structural modeling needs to be carried out using (f^2), (Q^2) and (R^2). Hence, to identify the impact of CSFs on project time the study tested the above hypothesis, and the result is given in table no 5.51. The effectiveness can be interpreted using the model's effect size (f^2), predictive relevance (Q^2) and the coefficient of determination (R^2).

Table 5.51

CSFs on Project Time (PLS SEM)

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
VDE →PT	-0.023	0.058	0.402	0.688	Failed to reject H0	0.005	0.313	89.4
CTE →PT	-0.100	0.088	1.133	0.257	Failed to reject H0	0.045		
OGR →PT	-0.019	0.025	0.746	0.456	Failed to reject H0	0.003		
ISR →PT	-0.017	0.024	0.697	0.486	Failed to reject H0	0.127		
PHS →PT	0.210	0.085	2.462	0.014*	Failed to accept H0	0.404		
FNS→PT	0.005	0.028	0.191	0.849	Failed to reject H0	0.189		
CNTS→PT	0.008	0.038	0.211	0.833	Failed to reject H0	0.033		

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
CTL →PT	0.041	0.046	0.886	0.376	Failed to reject H0	0.108		
EPV →PT	0.136	0.129	1.057	0.291	Failed to reject H0	0.257		
IMPA→PT	-0.560	0.188	30.678	0.003*	Failed to accept H0	0.988		

*Note: *significant at 5% significance level*

The study tested the above null hypothesis in the table 5.51, to identify whether the CSFs, vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP Package Vendor and implementation approaches have any significant impact on the time taken for the ERP implementation project. The result revealed that the time of ERP implementation was affected by the differences in the number of ERP implemented branches (positive impact) and differences in the implementation approaches adopted by the organisation (negative impact) as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on the project time ($\beta = 0.210$, $t = 2.462$, $p < 0.05$) and ($\beta = -0.560$, $t = 30.678$, $p < 0.05$) respectively.

The following hypotheses is formulated and tested using PLS-SEM to identify the impact of CSFs on Project Cost

H0: There is no significant impact of vendor evaluation on project cost.

H0: There is no significant impact of consultant evaluation on project cost.

H0: There is no significant impact of information system readiness on project cost.

H0: There is no significant impact of organisational readiness on project cost.

H0: There is no significant impact of consultancy services on project cost.

H0: There is no significant impact of customisation level on project cost.

H0: There is no significant impact of implementation approaches on project cost.

H0: There is no significant impact of ERP Vendors on project cost.

H0: There is no significant impact of physical scope on project cost.

H0: There is no significant impact of functional scope on project cost.

Table 5.52

CSFs on Project Cost (PLS SEM)

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
VDE →PC	0.037	0.023	1.641	0.101	Failed to reject H0	0.312	0.433	
CTE → PC	-0.026	0.067	0.396	0.692	Failed to reject H0	0.004		
OGR → PC	-0.045	0.031	0.087	0.176	Failed to reject H0	0.140		92.2%
ISR → PC	0.003	0.024	0.114	0.909	Failed to reject H0	0.005		
PHS → PC	-0.049	0.043	1.137	0.256	Failed to reject H0	0.055		
FNS→ PC	0.013	0.028	0.444	0.657	Failed to reject H0	0.110		
CNTS→ PC	0.286	0.092	3.114	0.002*	Failed to accept H0	0.588		
CTL → PC	0.351	0.078	4.514	0.000*	Failed to accept H0	0.478		
EPV → PC	-0.109	0.057	1.902	0.057	Failed to reject H0	0.215		
IMPA→ PC	0.149	0.086	1.734	0.083	Failed to reject H0	0.580		

*Note: *significant at 5% significance level*

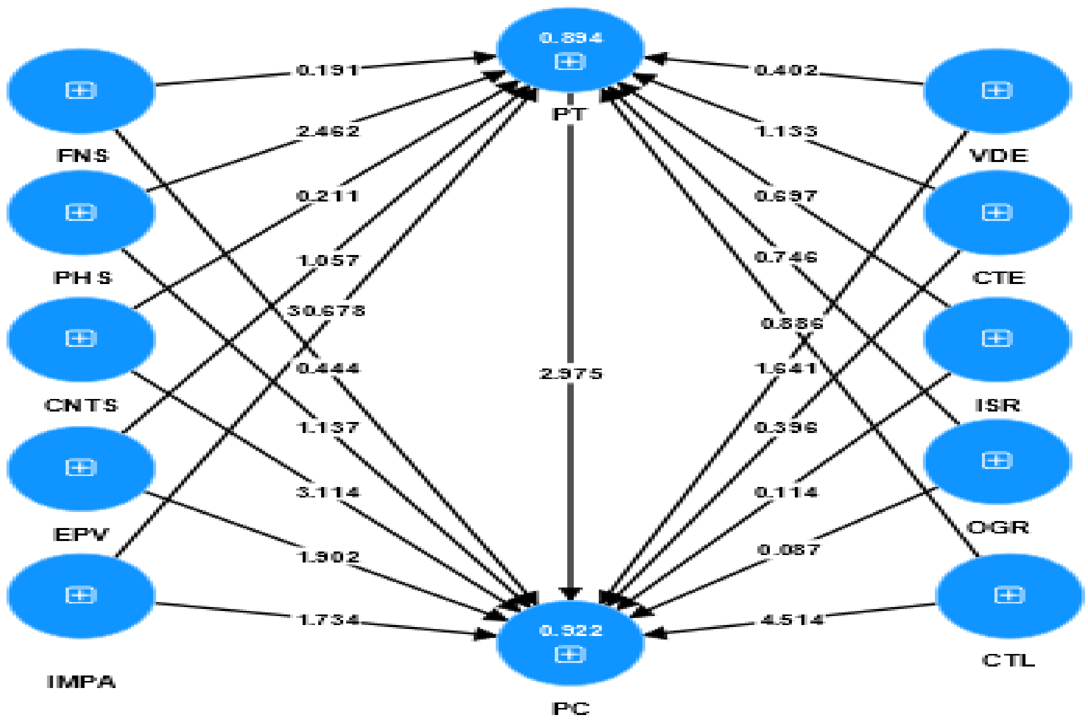
To determine the effect of the CSFs, vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP Vendor and implementation approaches on the cost of ERP implementation, the study tested the null hypothesis using Structural Equation Modelling. From the test result in the table 5.52 it is found that the adoption of consultants and the difference in customization level made a positive impact on the project cost as the path coefficient or beta value is sufficient and the p value is indicating a significant positive impact on the project cost (β = 0.286, t =3.114, $p < 0.05$) (β = 0.351, t = 4.514, $p < 0.05$).

5.6.3 PLS SEM: Impact of ERP implementation CSFs on the Project Time and Project Cost

The Figure 5.5, presents the model fit of the impact of ERP implementation CSFs on the Project Time and Project Cost

Figure 5.5

PLS SEM Model: Impact of ERP implementation CSFs on the Project Time and Project Cost (Mediating)



The path value is showing a significant impact of the independent variable on the dependent variable, but it is important to measure the significant impact of each exogenous variable on the endogenous variable because in a structural model a variable can be affect or influenced by any number of variables. So, it is essential to determine the effectiveness in the R^2.

The result shows that 89.4% variance in the duration of ERP implementation can be accounted for by vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP Vendor and implementation approaches together as the R^2 is 0.89.4 and also 92.2% variance in the cost of the ERP implementation project can be accounted for by vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP Vendor and implementation approaches together as the R^2 is 0.922

Here, regarding the effect of CSFs on project time, the physical scope and implementation approaches have larger impact, functional scope and ERP Vendor have medium impact and the customisation level and information system readiness have small impact and consultancy services, vendor evaluation, organisational readiness and consultant evaluation have no impact on the project time. The result is also indicating that, the consultancy services, customisation level and implementation approaches have larger impact, vendor evaluation and ERP Vendor have medium impact and the functional scope, organisational readiness and physical scope have small impact and information system readiness and consultant evaluation have no impact on the cost of ERP implementation.

According to Cohen (1988) the small effect: f-square is ≥ 0.02, medium effect: f-square ≥ 0.15 and large effect: f square is ≥ 0.35)

The value used in the model is reconstructed perfectly and the model has a predictive relevance as the $Q^2 > 0$

5.6.4 Impact: Project Time and Project Cost

Mediating Analysis

From the figure 5.5, the study identified that the time taken for ERP implementation has a significant positive impact on the cost of ERP implementation as the t value is 2.975 (β=0.607 and $p<0.05$) and hence, failed to accept the H0. Thus, there is a significant impact of the project time on the project cost. Here, in this section the study is assessing the total impact of CSFs on the project cost mediating role of project time on the linkage between the CSFs and the cost of ERP implementation.

The result (see Table no:5.53) of the mediating analysis revealed that the **total effect** of the CSFs; consultancy services, customisation level, ERP Vendor and organisational readiness on project cost, are significant (CNTS: β=0.286, t=3.119, $p<0.05$) (CTL: β=0.351, t=4.540, $p<0.05$) (EPV: β=0.108, t=2.004, $p<0.05$), (OGR: β=0.944, t=30.586, $p<0.05$). With the inclusion of the mediating variable project time, the impact of CSFs (**Direct effect**): consultancy services, customisation level, and organisational readiness on project cost became significant (CNTS: β=0.286, t=3.114, $p<0.05$) (CTL: β=0.351, t=4.514, $p<0.05$) (OGR: β=0.945, t=30.678, $p<0.05$). The **indirect effect** of the CSFs: consultancy services, customisation level, physical scope and organisational readiness on project cost through project time was found significant (CNTS: β=0.070, t=2.529, $p<0.05$) (CTL: β=0.566, t=9.682, $p<0.05$) (PHS: β=0.249, t=5.027, $p<0.05$) (OGR: β=0.170, t=4.387, $p<0.05$). The result shows that:

- The project time had a **complete mediating** role in making variations in project cost regarding the CSF, physical scope (direct effect is insignificant and indirect effect is significant)
- The project time had a **partial mediating** role in effecting the project cost regarding the CSFs: consultancy services, customisation level, and organisational readiness (both direct and indirect effects are significant)

Table 5.53

Mediation Analysis (CSFs →Project Time → Project Cost)

CSFs	Total Effect (CSFs → PC)		Direct Effect (CSFs →` PC)		Indirect Effect (CSFs →PT→PC)			
	Coefficient	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**SD**	**T values**	**P values**
CNTS	0.286	0.002*	0.286	0.002*	0.070	0.028	2.529	0.011*
CTE	-0.026	0.691	-0.026	0.692	0.014	0.162	0.089	0.929
CTL	0.351	0.000*	0.351	0.000*	0.566	0.059	9.682	0.000*
EPV	0.108	0.045*	0.109	0.057	0.046	0.038	1.209	0.227
FNS	0.013	0.655	0.013	0.657	0.007	0.026	0.259	0.796
IMPA	0.152	0.077	0.149	0.083	0.019	0.175	0.108	0.914
ISR	0.003	0.911	0.003	0.909	0.003	0.065	0.046	0.964
OGR	0.944	0.000*	0.945	0.000*	0.170	0.039	4.387	0.000*
PHS	0.048	0.263	0.049	0.256	0.249	0.050	5.027	0.000*
VDE	0.037	0.096	0.037	0.101	0.006	0.086	0.064	0.949

*Note: *significant at 5% significance level*

5.7 Summary

The present chapter analysed the differences in the Critical Success Factors opted by the organisations in the process of ERP implementation made any significant differences in the duration of ERP implementation and the cost of ERP implementation. The Kruskal Wallis test, Dunn Test and Mann Whitney U test were used to identify the differences in project cost and project time. Using the Spearman Correlation and regression using PLS SEM, the study analysed the association and impact of CSFs on the project time and project cost. With PLS SEM the study made a mediating analysis of project time on project cost. From the analysis it had found that even there is difference in the project time due to the differences in the CSFs in the process of ERP implementation, the test result showed a statistically significant difference only due to the difference in the implementation approaches adopted by the organisations. But in the case of project cost, the variation in the CSFs -physical scope, consultant viability, end-user training efficiency, customisation level, system testing efficiency and consultancy services made a statistically significant difference in the cost of implementation. Tables 5.54 and 5.55 concludes the test results by presenting those CSFs which make a significant difference in project time and project cost respectively.

CSFs on Project Time

The study identified that only the differences in the implementation approaches adopted by the organisations made differences in the time of ERP implementation.

Table 5.54

CSFs – Significant Difference in Project Time (Summary)

Hypotheses	Result	Decision	Findings
Implementation Approaches → Project Time	Significant Difference	Failed to accept H0	Big Bang- Project Time ↓ Roll Out- Project Time ↑

CSFs on Project Cost

The study found that the following CSFs have a significant impact on the project cost.

a. The difference in the number of ERP implemented branches of the selected organisations

b. The difference in the viability of the vendor and the consultant

c. The difference in the efficiency of providing training to the end-users.

d. The difference in the customization level

e. The adoption and non-adoption of the consultancy services and finally

f. The difference in the efficiency in system testing

Table 5.55

CSFs – Significant Difference in Project Cost (Summary)

Hypotheses	Result	Decision	Findings
Physical Scope → Project Cost	Significant Difference	Failed to accept H0	Physical Scope↑ Project Cost ↑
Vendor Viability → Project Cost	Significant Difference	Failed to accept H0	Vendor Viability↑ Project Cost ↑
Consultant Viability → Project Cost	Significant Difference	Failed to accept H0	Consultant Viability↑ Project Cost ↑
End-User Training → Project Cost	Significant Difference	Failed to accept H0	Training Efficiency↑ Project Cost ↑
Customisation Level → Project Cost	Significant Difference	Failed to accept H0	Customisation Level↑ Project Cost ↑
Consultancy Services → Project Cost	Significant Difference	Failed to accept H0	ERP implementation with Consultancy Services- Project Cost ↑
System Testing → Project Cost	Significant Difference	Failed to accept H0	System Testing Efficiency↑ Project Cost ↓

From the analysis, it can conclude that the CSFs in the process of ERP implementation had an impact on the cost and time of the ERP implementation project. The more time taken by the organization in the process of ERP implementation, the more is the cost of ERP implementation.

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Chapter Six

ERP IMPLEMENTATION IMPACT: ORGANISATIONAL CAPABILITY

6.1. Introduction

For analysis, the research objectives were classified into three. The first part was discussed in the previous chapter about the effect of selected CSFs on the time and cost of ERP implementation. This chapter presents in detail the analysis of the impact of the selected CSFs (project scope (functional scope, physical scope), vendor evaluation (vendor viability, vendor scalability), consultant evaluation (consultant viability, consultant scalability), software readiness (ERP package vendor, customisation level, consultant services, implementation approaches), organisation readiness (resource mobilisation, BPR, end-user training) and information system readiness (data migration, system testing and system upgradation))on the capability of the organisation wholly and the impact on its components individually (inbound logistics, outbound logistics, operational excellence, decision making and strategic impact). Primary data were collected with the use of two sets of questionnaires. Hypotheses were tested to know the significant difference between the dependent and independent variables that explains the impact of CSFs of ERP implementation on the capability of organisation and its components.

The previous chapter already validated the independent variables used for the study i.e., validated the Lower Order Constructs of the study. The study considered the ERP implementation project cost and project time up to the date of its functionalization. It considered the impact of system upgradation only to find the organizational impact as the study gathered the primary and secondary data from the organsiations which had been using the ERP system for more than ten years. The study took system upgradation as an independent variable to know its impact on the organisation. It is reliable to use system upgradation to test how its level of efficiency makes differences in the capability of the organisation. The Table 5.17, 5.18, 5.19 and figure 5.4 in the previous chapter illustrates the validation of the Lower Order Constructs, system upgradation.

This chapter begins with the validation of Higher Order Constructs inbound logistics, outbound logistics, operational excellence, decision making and strategic impact, following the validation of organisational capability. After validating the Higher Order Constructs the study tried to find the association of selected variables on the organizational capability, but it indicates the effect only on the capability of the organisation as a whole. The next section interprets the changes in the dependent variables with the differences in each component of the organisational capability. Finally, the study analyses the impact of the independent variables on the organisational capability and its components.

6.2 Validation of Higher Order Constructs (HOCs):

One of the objectives of the research is to identify the impact of CSFs on organisational capability. After validating the Lower Order Constructs (vendor evaluation, consultant evaluation, organisational readiness and information system readiness in previous chapter), the next step is the validation of the Higher Order Constructs i.e., in this case organisational capability. But there are five different components which are the contributors to the organisational capability, and it is also essential to study the impact of the identified CSFs on the components of organisational capability individually. Hence, like validating organisational capability it is necessary to validate inbound logistics Capability, outbound logistics, operational excellence, decision making and strategic impact following the validation of organisational capability. The Latent Variable Score generated from the measurement model of Lower Order Constructs is required to measure the Higher Order Model (inbound logistics, outbound logistics, operational excellence, decision making and strategic impact).

6.2.1 Organisational Capability Measurement Model

Finding the impact of organisational capability is one of the study objectives. So, validating organisational capability is very essential (Higher Order Constructs) and that is shown in the below Table 6.1 and interpreted thereafter.

Table 6.1

Validity Indices – Organisational Capability Measurement Model

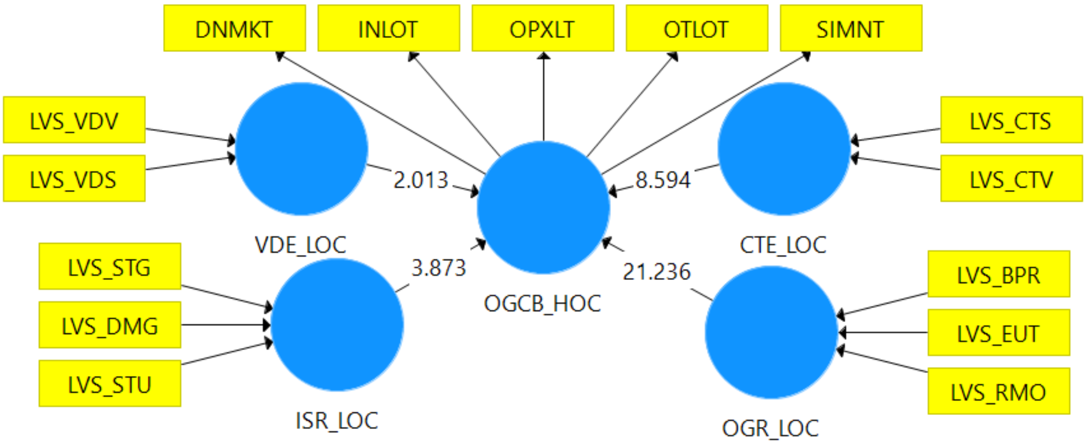
HOC	LOCs	Outer Weights	T statistics	P Value	VIF
INLO	VDE	0.189	2.013	0.021	1.440
	CTE	0.322	8.594	0.004	2.199
	OGR	0.080	21.236	0.000	1.476
	ISR	0.419	3.873	0.000	1.305

In this section, the study validates the Higher Order Constructs from the Latent Variable Score (LVS) generated after validating Lower Order Constructs. Finding the impact of vendor evaluation, consultant evaluation, organisational readiness and information system readiness on organisational capability is very significant, hence it is essential to validate the model. To establish the validity of Higher Order Constructs the Outer weights and Variance Inflation Factor (VIF) value was considered. The outer weights were found significant as the p value is less than 0.05 and T statistics are greater than 1.96. Here, Higher Order Constructs is a formative model, hence it is significant to check the collinearity by assessing the VIF values and found that none of the indicators represents a value above the threshold value 5 suggested by Hair et al., (2016). Since, all the criteria for Higher Order Constructs validation are met, here, the organisational capability - Higher Order Constructs validity was established.

The study validated the organisational capability Measurement Model through CFA and formulated a five-factor model for representing the associations, which is presented in figure 6.1.

Figure 6.1

Organisational Capability Measurement Model



6.2.2 Inbound Logistics Measurement Model

Table 6.2

Validity Indices – Inbound Logistics Measurement Model

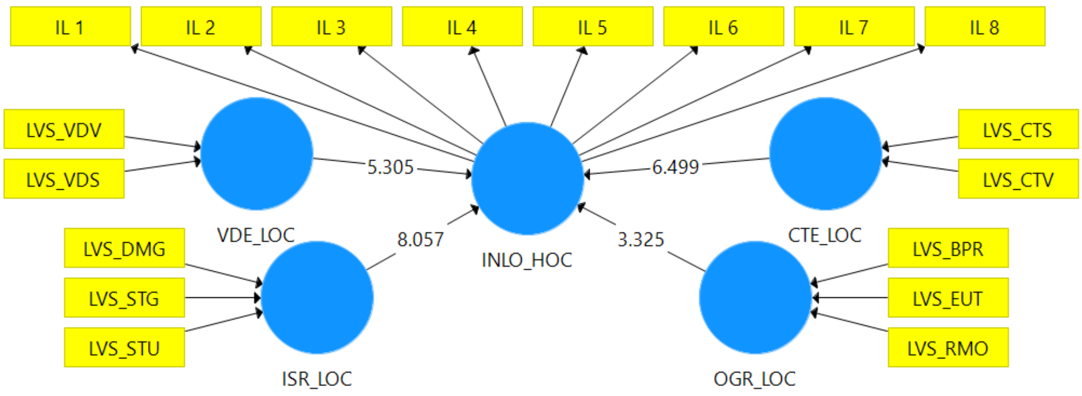
HOC	LOCs	Outer Weights	T statistics	P Value	VIF
INLO	VDE	0.166	5.305	0.000	1.535
	CTE	0.395	6.499	0.000	1.261
	OGR	0.092	3.325	0.001	1.542
	ISR	0.471	8.057	0.000	1.274

In the Table 6.2, the study validates the Higher Order Constructs from the Latent Variable Score generated after validating Lower Order Constructs. Inbound logistics is one of the Higher Order Constructs for finding the impact of vendor evaluation, consultant evaluation, organisational readiness and information system readiness. To establish the validity of Higher Order Constructs the Outer weights and VIF value was considered. The outer weights were found significant as the p value is less than 0.05 and T statistics are greater than 1.96. Here, Higher Order Constructs is a formative model, hence it is significant to check the collinearity by assessing the VIF values and found that none of the indicators represents a value above the threshold value 5 suggested by (Hair et al., 2016). Here, the Higher Order Construct's validity was established, since all the criteria for Higher Order Constructs validation are met.

The study validated the inbound logistics Measurement Model through Confirmatory Factor Analysis (CFA) and formulated a five-factor model for representing the associations, which is presented in the figure 6.2

Figure 6.2

Inbound Logistics Measurement Model



6.2.3 Outbound Logistics Measurement Model

Table 6.3

Validity Indices – Outbound Logistics Measurement Model

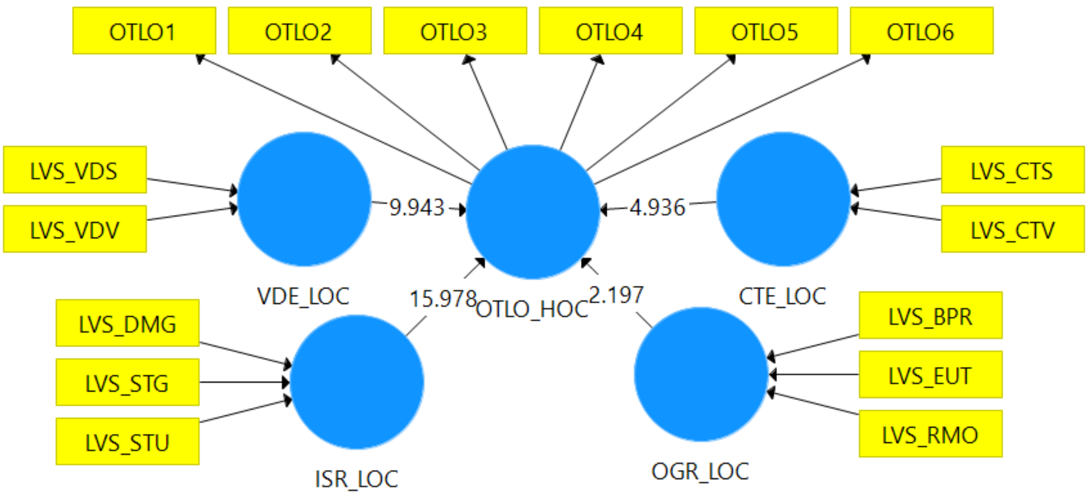
HOC	LOCs	Outer Weights	T statistics	P Value	VIF
OTLO	VDE	0.267	9.943	0.003	1.970
	CTE	0.110	4.936	0.000	2.168
	OGR	0.059	2.197	0.000	1.259
	ISR	0.402	15.978	0.000	1.130

In Table 6.3, the study validates the Higher Order Constructs from the Latent Variable Score generated after validating Lower Order Constructs. Outbound logistics is one of the Higher Order Constructs for finding the impact of vendor evaluation, consultant evaluation, organisational readiness and information system readiness. To establish the validity of Higher Order Constructs the Outer weights and VIF value was considered. The outer weights were found significant as the p value is less than 0.05 and T statistics are greater than 1.96. Here, Higher Order Constructs are a formative model, hence it is significant to check the collinearity by assessing the VIF values and found that none of the indicators represents a value above the threshold value 5 suggested by (Hair et al., 2016). Since, all the criteria for Higher Order Constructs validation are met, here, the Higher Order Constructs validity was established.

The study validated the outbound logistics Measurement Model through CFA and formulated a five-factor model for representing the associations, which is presented in figure 6.3.

Figure 6.3

Outbound Logistics Measurement Model



6.2.4 Operational Excellence Measurement Model

Table 6.4

Validity Indices – Operational Excellence Measurement Model

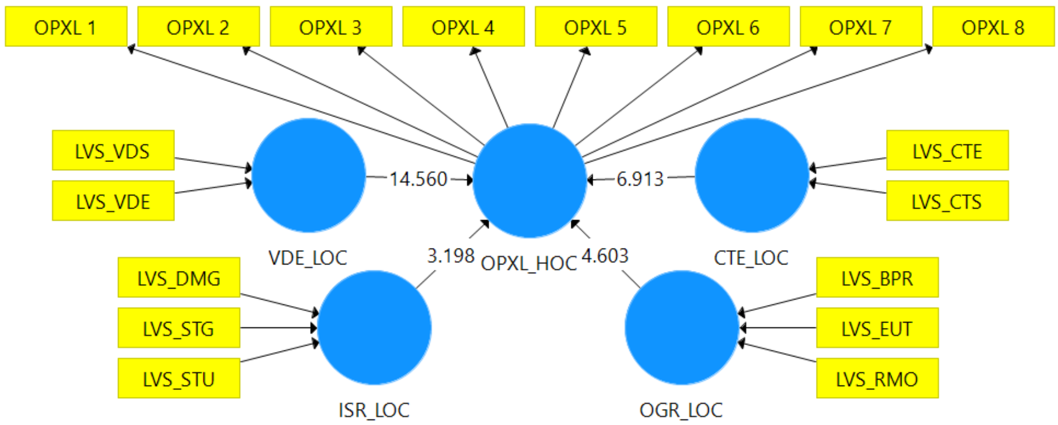
HOC	LOCs	Outer Weights	T statistics	P Value	VIF
OPXL	VDE	0.225	14.560	0.000	1.198
	CTE	0.157	6.913	0.000	1.174
	OGR	0.412	4.603	0.000	1.239
	ISR	0.149	3.198	0.000	1.165

In Table 6.4, the study validates the Higher Order Constructs from the Latent Variable Score generated after validating Lower Order Constructs. operational excellence the one of the Higher Order Constructs for finding the impact of vendor evaluation, consultant evaluation, organisational readiness and information system readiness. To establish the validity of Higher Order Constructs the Outer weights and VIF value was considered. The outer weights were found significant as the p value is less than 0.05 and T statistics are greater than 1.96. Here, Higher Order Constructs are a formative model, hence it is significant to check the collinearity by assessing the VIF values and found that none of the indicators represents a value above the threshold value 5 suggested by Hair et al., (2016). Since, all the criteria for Higher Order Constructs validation are met, here, the Higher Order Constructs validity was established.

The study validated the operational excellence Measurement Model through CFA and formulated a five-factor model for representing the associations, which is presented in figure 6.4.

Figure 6.4

Operational Excellence Measurement Model



6.2.5 Decision Making Measurement Model

Table 6.5

Validity Indices – Decision Making Measurement Model

HOC	LOCs	Outer Weights	T statistics	P Value	VIF
OPXL	VDE	0.119	6.474	0.000	2.211
	CTE	0.372	3.169	0.005	1.276
	OGR	0.299	4.053	0.000	1.149
	ISR	0.320	31.825	0.000	1.567

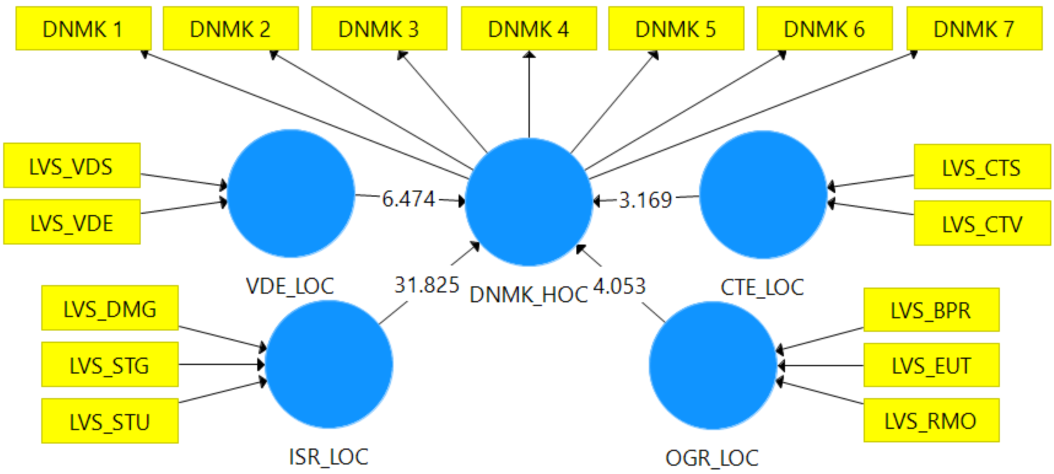
Table 6.5 presented the result of the validation of Higher Order Constructs from the Latent Variable Score generated after validating Lower Order Constructs. decision making is one of the Higher Order Constructs for finding the impact of vendor evaluation, consultant evaluation, organisational readiness and information system readiness. To establish the validity of Higher Order Constructs the Outer weights and VIF value was considered. The outer weights were found significant as the p value is less than 0.05 and T statistics are greater than 1.96. Here, Higher Order Constructs are a formative model, hence it is significant to check the collinearity by assessing the VIF values and found that none of the indicators represents a value above the threshold value 5 suggested by Hair et al., (2016). Since all the criteria for Higher

Order Constructs validation are met, here, the Higher Order Constructs validity was established.

The study validated the decision-making Measurement Model through CFA and formulated a five-factor model for representing the associations, which is presented in the figure 6.5

Figure 6.5

Decision Making Measurement Model



6.2.6 Strategic Impact Measurement Model

Table 6.6

Validity Indices – Strategic Impact Measurement Model

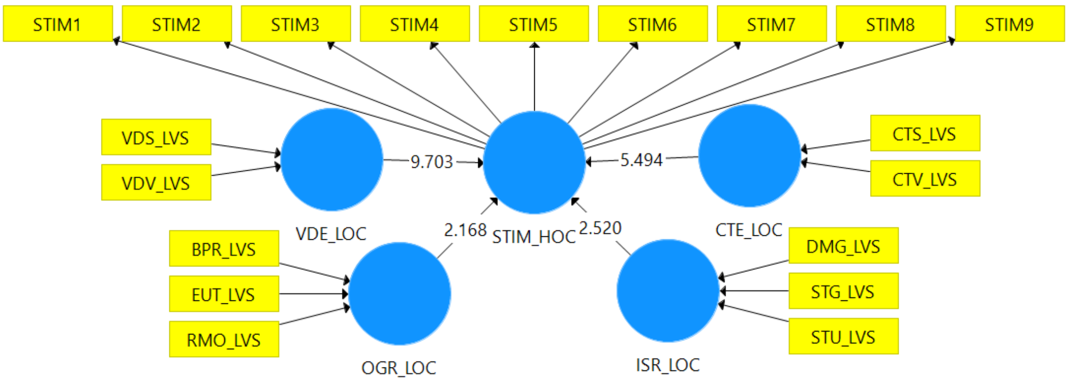
HOC	LOCs	Outer Weights	T statistics	P Value	VIF
STIM	VDE	0.388	9.703	0.000	1.769
	CTE	0.291	5.494	0.000	2.273
	OGR	0.190	2.168	0.000	1.939
	ISR	0.155	2.520	0.001	1.551

In Table 6.6, the study validates the Higher Order Constructs from the Latent Variable Score generated after validating Lower Order Constructs. Strategic impact is one of the Higher Order Constructs for finding the impact of vendor evaluation, consultant evaluation, organisational readiness and information system readiness. To establish the validity of Higher Order Constructs the Outer weights and VIF value was considered. The outer weights were found significant as the p value is less than 0.05 and T statistics are greater than 1.96. Here, Higher Order Constructs are a formative model, hence it is significant to check the collinearity by assessing the VIF values and found that none of the indicators represents a value above the threshold value 5 suggested by Hair et al., (2016). Since all the criteria for Higher Order Constructs validation are met, here, the Higher Order Constructs validity was established.

The study validated the strategic impact Measurement Model through CFA and formulated a five-factor model for representing the associations, which is presented in figure 6.6.

Figure 6.6

Strategic Impact Measurement Model



Result of validation: None of the Higher Order Constructs were removed due to lack of validation issues.

The validity of the measurement scales eliminated the issues of factor loadings, reliability, Construct validity (Convergent and Discriminant Validity – Fornell Larcker criterions, Cross loading and HTMT) and the variables are fit for further research activities.

After validation, the next part of the study is the analysis of the associations and differences between variables if any.

6.3 CSFs: Impact on Organisational Capability

The following section is classified into six as per the dependent variable. Under each section, the analysis was done for finding the associations and differences of sixteen CSFs on the organizational capability and its components (dependent variables). In the final section, impact analysis of the selected CSFs on the organisational capability using PLS SEM, which covers categorical and metric data respectively, is carried out.

- **Tests Used**

After the exploration and validation of the measurement models, the study analysed the differences of the dependent and independent variables using Kruskall Wallis test, Mann whitening U test and Dunn test. PLS SEM was used for identifying the impact of CSFs on organisational capability.

6.3.1 Project Scope and Organisational Capability

The association of project scope on organisational capability was analysed with the association of functional scope and physical scope on organisational capability.

A. Functional Scope and Organisational Capability

The following hypothesis was developed and tested to know whether the differences in the modules adopted by the organisation made variations in the organisational capability.

H0: There is no significant difference in organisational capability with the differences in functional scope.

The study identified more than two categories of modules which are implemented in the organisation and found that Kruskal Wallis test was the appropriate test for analysing the impact of the categorical data with three or more categories, which is used here to test the hypothesis.

Table 6.7

Differences- Functional Scope and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	□2	P Value
Level 0: Single Module	16	72.28		
Level 1: Core Module	42	81.10		
Level 2: Level 1 + HR &/or PM	43	93.01	5.120	0.163
Level 3: Level 2 + All preceding levels	59	73.19		
Total	160			

The result in Table 6.7 reveals that, since the $p>0.05$, the study failed to reject the null hypothesis. Hence, there is no significant difference in the organisational capability with the difference in the type of modules implemented.

B. Physical Scope and Organisational Capability

To analyse, the changes in organisational capability due to differences in the physical scope of ERP implementation, the study formulated the following hypotheses and tested. Here Kruskal Wallis Test is used for analysing the impact, as there are more than two categories of data in the independent variables.

H0: There is no significant difference in organisational capability with the differences in physical scope.

Table 6.8

Differences: Physical Scope and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	χ^2	P Value
Zero Branches	13	96.81		
1 to 10 Branches	81	85.16	5.328	0.149
11 to 20 Branches	46	74.07		
Above 20 Branches	20	65.83		
Total	160			

Since p>0.05, the study failed to reject the null hypothesis and Table 6.8 indicates that the difference in the physical scope does not make any significant difference in the organisational capability.

6.3.2 Vendor Evaluation and Organisational Capability

The study identified two factors to evaluate the efficiency of the vendor. One is vendor viability (vendor viability) and the other one is the vendor scalability (vendor scalability).

The previous chapter presented the efficiency level of vendors. Hence, after categorizing the efficiency of ERP vendors by evaluating their Viability and Scalability, it is required to analyse the variations in organisational capability due to the differences in the efficiency of vendors selected.

A. Vendor Viability and Organisational Capability

The study constructed the following hypothesis to test whether the differences in the vendor viability efficiency made any changes in the organisational capability.

H0: There is no significant difference in organisational capability with the differences in vendor viability.

Table 6.9

Differences- Vendor Viability and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	32	85.00		
Average Efficiency	93	84.82	5.074	0.079
Poor Efficiency	35	64.91		
Total	160			

The study found that the p>0.05, hence the study failed to reject the null hypothesis. The test result in the above Table 6.9 indicates that there is no significant difference in the organisational capability as per the changes in the efficiency of vendor viability.

B. Vendor Viability and Organisational Capability

The study developed the following hypothesis to check whether there is any difference in the organisational capability due to the changes in the efficiency of the scalability of ERP vendor.

H0: There is no significant difference in organisational capability with the difference in vendor scalability.

Table 6.10

Differences- Vendor Scalability and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	67	94.18		
Average Efficiency	63	75.45	12.159	0.002*
Poor Efficiency	30	60.55		
Total	160			

Note: * The mean difference is significant at the 0.05 level.

The test result in table 6.10 indicates that there are significant differences in organisational capability due to the differences in the vendor's efficiency in Scalability $\chi^2 = 12.159$, P=0.002 ($p<0.05$). Hence, the study failed to accept the null hypothesis. The above Table 6.10 presents the Mean Rank, test, and the asymptotic significance (2 tailed) P-value.

As the test result shows a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.11.

Table 6.11

Pairwise Comparisons: Vendor Scalability and Organisational Capability

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.00-2.00	14.902	10.274	1.451	.147
3.00-1.00	33.629	10.175	3.305	.001
2.00-1.00	18.727	8.128	2.304	.021

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

From the pairwise comparison it was found that there is a significant difference in the organisational capability of firms having vendors with lower and average ERP system scalability efficiency while comparing with the firms which have higher efficiency in scalability. The mean rank indicates a decreasing trend of organisational capability when the vendor scalability efficiency is poor, the mean rank is higher with firms having higher vendor scalability efficiency.

6.3.3 Consultant Evaluation and Organisational Capability

After categorizing the efficiency in Viability and Scalability in the previous chapter Table, the study analyses the association of consultant evaluation via consultant viability and consultant scalability with the organisational capability.

A. Consultant Viability and Organisational Capability

The following hypothesis is formulated for testing the differences in organisational capability due to differences in the efficiency of consultant viability.

H0: There is no significant difference in organisational capability with the differences in consultant viability.

Table 6.12

Differences- Consultant Viability and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	42	85.26		
Average Efficiency	36	80.83	1.534	0.464
Poor Efficiency	50	73.49		
Total	128			

The Kruskal-Wallis test in Table 6.12 reveals that, since $p>0.05$, the study failed to reject the null hypothesis. Hence, there is no significant difference in organisational capability as per the variations in the efficiency of consultant viability.

B. Consultant Scalability and Organisational Capability

The following hypothesis is formulated for testing the variations in organisational capability due to the changes in the scalability of EPR consultant.

H0: There is no significant difference in organisational capability with the differences in consultant scalability.

Table 6.13

Differences- Consultant Scalability and Organisational Capability (Kruskal Wallis Statistic)

Efficiency Level	N	Mean Rank	Chi square	P Value
High Efficiency	39	110.77		
Average Efficiency	34	73.68	39.439	0.000*
Poor Efficiency	55	56.43		
Total	128			

Note: * The mean difference is significant at the 0.05 level.

The Kruskal Wallis Statistic is used to test whether the differences in the efficiency in consultant scalability made any differences in the organisational capability with the Mean Rank, test, and the asymptotic significance (2 tailed) P-value. The test result in the above Table 6.13 is indicating that there is significant difference in the efficiency of organisational capability due to the differences in the efficiency in the scalability of consultant as $\chi^2 = 39.439$ and P=0.000 ($p<0.05$). Hence the study failed to accept the null hypothesis. As the test result proved a significant difference, the study made a pairwise comparison to find out the differences in three categories of consultant scalability efficiency used for the study. The test result of pairwise comparison is given in the Table 6.14

Table 6.14

Pairwise Comparisons: Consultant Scalability and Organisational Capability

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.00-2.00	17.253	9.050	1.906	.057
3.00-1.00	54.345	8.832	6.153	.001
2.00-1.00	37.093	9.050	4.099	.001

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

Table 6.14 reveals significant differences in the organisational capability of the firms which opted for the consultant having a lower efficiency in scalability with the firms having consultant with higher scalability efficiency. The mean rank in the Kruskal Wallis test result shows that the organizational capability is decreasing in the firms where the consultant Scalability efficiency is lower, and it increases as the consultant scalability efficiency is higher.

6.3.4 Software Readiness and Organisational Capability

A. ERP Package Vendor and Organisational Capability

The study classified the ERP providers into two categories as per their position in the ERP market, hence, to check whether the difference in selection of vendor by the organisations made any variations in the organisational capability. The leading vendor of ERP is SAP (Panorama, 2019), which is categorized into a group, and the remaining vendors into another category.

The study needs to check whether there is any difference in the organisational capability due to the differences in the ERP Vendors opted for ERP implementation. The following hypothesis is formulated and tested to check the difference.

H0: There is no significant difference in organisational capability with the difference in ERP Package Vendor.

Table 6.15

Differences- ERP Package Vendor and Organisational Capability (Mann-Whitney U)

Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	P value
SAP	120	79.68	2302.000	9562.000	-0.386	0.699
Others	40	82.95				
Total	160					

The Table 6.15 indicates that the p-value> 0.05, hence the study fails to reject the null hypothesis and it is proved that there is no significant difference in organisational capability as per the differences in the selection of the ERP Vendor by different organisations.

B.Customisation Level and Organisational Capability

The following hypothesis was developed to check whether the differences in the customisation level made any variations in the capability of the organisation.

H0: There is no significant difference in organisational capability with the differences in customisation level.

Table 6.16

Differences- Customisation Level and Organisational Capability (Kruskal-Walli's test)

Customisation Level	N	Mean Rank	Chi square	P Value
Zero customisation	49	16.00	112.516	0.002
Minor customisation (1-10%)	34	143.50		
Moderate Customisation (11-25%)	46	95.48		
Major Customisation (26-50%)	31	48.05		
Total	160			

Note: * The mean difference is significant at the 0.05 level.

Table 6.16 provides the Mean Rank, test, and the asymptotic significance (2 tailed) P-value. The test was done to prove whether the differences in the customisation level were made any difference in the organisational capability, and it was found that the study failed to accept the null hypothesis, since χ^2 = 112.516, P=0.002 (p<0.05). Hence, the study identified that there is significant difference in organisational capability as per the differences in the customisation level of the ERP software. As the test result shows a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.17.

Table 6.17

Pairwise Comparisons: Customisation Level and Organisational Capability

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
Zero customisation-Major Customisation (26-50%)	-32.045	11.584	-2.766	.006*
Zero customisation-Moderate Customisation (11-25%)	-79.476	10.188	-7.801	.001*
Zero customisation-Minor Customisation (1 -10%)	-127.500	11.501	-11.086	.000*
Major Customisation (26-50%)-Moderate Customisation (11-25%)	47.430	9.980	4.753	.001*
Major Customisation (26-50%)-Minor Customisation (1 -10%)	95.455	11.318	8.434	.000*
Moderate Customisation (11-25%)-Minor Customisation (1 -10%)	48.024	9.884	4.859	.001*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

From the pairwise comparison, it was found that all pairs are showing a statistically significant difference as the $p<0.05$. The mean rank is indicating that the organisational capability increases at minor customisation and it decreases at moderate customisation, major customisation and at zero customisation respectively.

C. Consultancy Services and Organisational Capability

It is the option of the enterprises whether to adopt the consultancy services or not while implementing the ERP project. It is significant to study whether the adoption and non-adoption of consultancy service by different enterprises made any changes in the organizational capability and its components. The following hypotheses were formulated and tested to check the differences in the organizational capability of firms who does not adopt the consultancy services and the firms who doesn't adopted such services.

H0: There is no significant difference in organisational capability with the adoption of consultancy services.

Table 6.18

Differences- Consultancy Services and Organisational Capability (Mann-Whitney U)

CNTS	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	P Value
Adopted	128	80.01	1985.500	10241.500	-0.267	0.790
Not adopted	32	82.45				
Total	160					

It is observed from Table 6.18 that since the p-value > 0.05, the study failed to reject the null hypothesis. Hence, identified that the organisations which adopted the consultancy services and those which did not adopt the consultancy services for the ERP implementation do not vary significantly in the organisational capability of the organisation

D. Implementation Approaches and Organisational Capability

There are different approaches for implementing the ERP system in an organisation. From the collected data, the study observed three different approaches for ERP implementation. It is significant to test whether the different implementation approaches have different results in the organizational capability and its components.

The following hypothesis is formulated to test the differences in organisational capability due to the differences in ERP implementation approaches of the organisation.

H0: There is no significant difference in organisational capability with the differences in implementation approaches.

Table 6.19

Differences- Implementation Approaches and Organisational Capability (Kruskal-Walli's test)

Implementation approaches	N	Mean Rank	Chi square	P Value
Big bang	94	80.80	.024	0.988
Modules Wise	50	80.47		
Roll out	16	78.84		
Total	160			

From the test in Table 6.19, it was found that $p>0.05$, there is no evidence to reject the null hypothesis. Hence, there is no significant difference between the implementation approaches and the organisational capability.

6.3.5 Organisational Readiness and Organisational Capability

The organisations should ensure that proper measures have been taken by them before implementing a huge project. There should be a definite inevitable pace need to follow by the firms before implementing ERP. The organisation should take at most care in such pace especially in changing their business process, preparing their manpower and to ensure proper supply of resources. This part of the study is focusing on such measures taken by the organisation, the firm's efficiency to manage such measures and finally analysing, whether differences in efficiency of managing such factors made any changes in the organisational capability and its components.

After categorizing the efficiency in resource mobilisation, BPR and end-user training, the study is required to analyse the association between the CSFs under organisational readiness with the organisational capability.

A. Resource Mobilisation and Organisational Capability

The study needs to know whether the organisations are efficient in mobilizing the required resources for the proper implementation of ERP. After analyzing the efficiency, it was classified into poor efficiency, Average Efficiency and High Efficiency using the quartiles in the previous chapter. It is very significant to know whether there is any difference in organizational capability when the efficiency in resource mobilisation varies from organisation to organisation. The Kruskal Wallis statistic is used to test the association between efficiency in resource mobilisation and organisational capability.

The following hypothesis is formulated for testing whether the differences in the efficiency in mobilizing resources for implementing the ERP package made any differences in the organisational capability.

H0: There is no significant difference in organisational capability with the differences in resource mobilisation efficiency.

Table 6.20

Differences- Resource Mobilisation and Organisational Capability (Kruskal Wallis Statistic)

Efficiency Level	N	Mean Rank	Chi square	P Value
High Efficiency	62	111.92		
Average Efficiency	49	75.46	56.640	0.000*
Poor Efficiency	49	45.79		
Total	160			

Note: * The mean difference is significant at the 0.05 level.

The test result in the Table 6.20 reveals that the χ^2= 56.640, P=0.000 ($p<0.05$) hence, the study failed to accept the null hypothesis. It is indicated that the differences in resource mobilisation efficiency made a statistically significant difference in the organisational capability. Even though there are statistically significant differences, it is relevant to carry out as pairwise comparison as there are more than two categories of data. Table 6.21 exhibits the test result of pairwise comparison.

Table 6.21

Pairwise Comparisons: Resource Mobilisation and Organisational Capability

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	29.673	9.357	3.171	.002
3.000-1.000	66.134	8.853	7.470	.000
2.000-1.000	36.460	8.853	4.118	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The pairwise comparison also shows that there is significant differences between every pair of efficiency level and organizational capability as $p<0.05$. The mean score reveals that the organisation with high efficiency in the mobilization of resources contributes more to the organisational capability followed by average efficiency and poor efficiency in resource mobilisation respectively.

B. BPR and Organisational Capability

Before implementing the software, the organisation should conduct a deep study of the existing business operation because ERP integrates the entire business process through a single database. There may be changes in the business operation, without that the entire system may collapse. This reengineering process required proper planning and implementation. The efficiency in the BPR may help the organisation to receive an expected outcome with the ERP implementation. The above efficiency level of organisations in reengineering the business process for the proper implementation of the ERP system was identified in the previous chapter. The study developed the below hypothesis to test whether the differences in the identified efficiency level made any differences in the organisational capability.

H0: There is no significant differences in organisational capability due to the differences in BPR efficiency.

The below Table 6.22 indicates the test result of the above formulated hypothesis.

Table 6.22

Differences: BPR and Organisational Capability (Kruskal Wallis Statistic)

Efficiency Level	N	Mean Rank	Chi square	P Value
High Efficiency	44	87.89		
Average Efficiency	76	84.43	8.550	0.014*
Poor Efficiency	40	62.13		
Total	160			

Note: * The mean difference is significant at the 0.05 level

The test was done to prove whether the differences in the efficiency in BPR made any differences in the organisational capability with Mean Rank, test, and the asymptotic significance (2 tailed) P-value generated from the Kruskal Wallis test. The test result is indicating that since $\chi^2 = 8.550$, P=0.014 ($p<0.05$), the study failed to accept the null hypothesis. Hence, there is no statistically significant difference in organisational capability as per the changes in the BPR efficiency. As the test result is showing a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.23

Table 6.23

Pairwise Comparisons: BPR and Organisational Capability

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	22.307	10.118	2.205	.027*
3.000-1.000	25.770	9.047	2.848	.004*
2.000-1.000	-3.463	8.774	-0.395	.693

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The mean rank in the Table 6.23 is revealing differences in all the pairs of efficiency level, but the pairwise comparison in the above Table 6.23 is showing a statistically significant difference only in the pair of higher and average with lower efficiency as the $p<0.05$.

C. **End-User Training and Organisational Capability**

The organisation should prepare their manpower to accept the changes happening in the organisation. The new system is entirely different from the existing legacy system, without efficient training the organisation can't expect a positive outcome. For analysis, the study classified the efficiency in user training into three, poor efficiency, Average Efficiency and Highly Efficient using the quartiles and it is very significant to know whether there exist any differences in the organizational capability, when the efficiency in user training varies from organisation to organisation. The below hypothesis is formulated and tested to identify whether the differences in training efficiency made any changes in the organisational capability of the organisations

H0: There is no significant differences in organisational capability with the differences in end-user training efficiency.

Table 6.24

Differences: End-User Training and Organisational Capability (Kruskal Wallis Statistic)

Efficiency Level	N	Mean Rank	Chi square	P Value
High Efficiency	70	83.13		
Average Efficiency	50	80.71	.572	0.751
Poor Efficiency	40	76.65		
Total	160			

Since $p>0.05$ there is no evidence to reject the null hypothesis. Hence the test result in Table 6.24 is indicating that there is no significant difference in organisational capability as per the differences in the efficiency of end-user training.

6.3.6 Information System Readiness and Organisational Capability

The organisation should prepare their information system to adopt the new ERP system. The business should take proper steps to drift the existing data into the new ERP system. After data migration the organisation needs to conduct a trial run of the launched new IS to rectify the errors, omissions, data integration issues, security issues etc... After rectifying all such issues, the next step is going live. There must be proper upgradation of the launched ERP system so as to gain the expected performance. This section of the study is analysing the association of the information system readiness efficiency with the organisational capability.

After categorizing the efficiency in data migration, system testing and system upgradation in the previous chapter, the study is required to analyse the differences of these factors made any changes in organisational capability.

A. Data Migration and Organisational Capability

data migration is the process of converting data from the existing legacy system to the new ERP system. The organisation must be efficient enough to convert this data and its efficiency is analysed in the previous chapter and categorized the efficiency into three levels Poor, average and highly efficient. Now the study required to check whether the differences in the efficiency made any variations in the organizational capability.

The following hypothesis is formulated to test the significant differences in organisational capability as a result of differences in the efficiency in data migration. The Kruskal Wallis statistic is used to check the differences.

H0: There is no significant difference in organisational capability with the differences in data migration efficiency.

Table 6.25

Differences- Data Migration and Organisational Capability (Kruskal Wallis Statistic)

Efficiency Level	N	Mean Rank	Chi square	P Value
High Efficiency	49	83.67		
Average Efficiency	68	76.85	0.747	0.688
Low Efficiency	43	82.66		
Total	160			

From the test result in Table 6.25, it was found that, since the p value is greater than 0.05, the study failed to reject the null hypothesis. Hence, there is no significant difference in organisational capability as per the differences in the efficiency in data migration.

B. System Testing and Organisational Capability

If the organisation failed to conduct an efficient testing of the implemented ERP system, it may interrupt the whole business operations. The above Table no…is revealing the efficiency of system testing and categorized into three levels. In this section, the study is required to analyse, whether the differences in the efficiency level in testing the new ERP system before going live made any variations in the organisational capability. The following hypothesis is formulated to test the differences.

H0: There is no significant difference in organisational capability with the differences in system testing efficiency.

Table 6.26

Differences: System Testing and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	50	84.46		
Average Efficiency	67	84.87	3.569	0.168
Low Efficiency	43	69.09		
Total	160			

The test result in Table 6.26 indicates that the p>0.05 and hence the study failed to reject the null hypothesis. Hence, it is identified that there is no significant difference in the organisational capability due to the difference in the efficiency in system testing.

C. System Upgradation and Organisational Capability

Like every IS the ERP system may also expire, proper updation of the ERP system may extend such run out. The entire sample of the survey had done such up gradation. In the previous chapter, the efficiency of the organisation in system upgradation was classified into three levels. The study is required to check the differences in organisational capability as per the variations in the efficiency of the organisation in system upgradation. The following hypothesis is formulated to test its statistically significant differences.

H0: There is no significant difference in organisational capability with the difference in system upgradation efficiency.

Table 6.27

Differences: System Upgradation and Organisational Capability (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	87.73		
Average Efficiency	76	84.43	8.253	0.016*
Poor Efficiency	40	62.44		
Total	160			

Note: * The mean difference is significant at the 0.05 level

Table 6.27 provides the Mean Rank, test, and the asymptotic significance (2 tailed) P-value. The test was done to prove whether the differences in the efficiency in system upgradation made any differences in the organisational capability and it was found that there is significant difference $\chi^2 = 8.253$, P=0.016 ($p<0.05$). Hence, the study failed to accept the null hypothesis. There is a significant difference in organisational capability as per the differences in system upgradation efficiency of the organisation.

As the test result is showing a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.28

Table 6.28

Pairwise Comparisons: System Upgradation and Organisational Capability

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	21.994	10.118	2.174	.030
3.000-1.000	25.293	9.047	2.796	.005
2.000-1.000	-3.298	8.774	-0.376	.707

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The mean rank in Table 6.28 is revealing differences in all the pairs of efficiency level, but the pairwise comparison in the above table is showing a statistically significant difference only in pairs of lower efficiency with higher and average efficiency as the $p<0.013$.

6.4. CSFs: Impact on Inbound Logistics

After analysing the differences in organisational capability with the differences in the CSFs, the following sections are focusing on the difference in the components of organisational capability with the differences in the CSFs in the process of ERP implementation. In the following section, the study is analysing the differences that happened in the inbound logistics operation capabilities with the differences in the CSFs.

6.4.1 Project Scope and Inbound Logistics

Here, the study is analysing the difference in inbound logistics capability with the difference in the variables of project scope i.e., functional scope and physical scope.

A. Functional Scope and Inbound Logistics

The following hypothesis is developed to test whether the differences in the type of modules implemented make any statistically significant differences in the inbound logistics capabilities of the organisation.

H0: There is no significant difference in inbound logistics capability as per the differences in the functional scope.

Table 6.29

Differences: Functional Scope and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Level O: Single Module	16	73.88	2.295	0.514
Level 1: Core Module	42	79.87		
Level 2: Level 1 + HR &/or PM	43	89.14		
Level 3: Level 2 + All preceding levels	59	76.45		
Total	160			

The result of the Kruskal-Wallis test in Table 6.29 reveals that there is no significant difference between functional scope of ERP and the inbound logistics of the organisations as p>0.05, hence the study failed to reject the null hypothesis.

B. Physical Scope and Inbound Logistics

The following hypothesis is formulated to test the effect of number of ERP implemented branches on the inbound logistics of the organisation.

H0: There is no significant difference in inbound logistics capability with the difference in physical scope.

Table 6.30

Difference: Physical Scope and Inbound Logistics (Kruskal Wallis test)

	N	Mean Rank	Chi square	P Value
Zero Branches	13	89.88	7.023	.071
1 to 10 Branches	81	86.63		
11 to 20 Branches	46	76.87		
Above 20 Branches	20	57.93		
Total	160			

The study failed to reject the null hypothesis as p>0.05. The Kruskal Wallis test in Table 6.30 reveals that there is no significant difference in the performance of inbound logistics with the variations in the number of branches implemented the ERP software.

6.4.2 vendor evaluation and Inbound Logistics

A. **vendor viability and Inbound Logistics**

The study required to test whether the differences in the viability efficiency of ERP vendor made any changes in the inbound logistics capability of the organisation. The following hypothesis is formulated to test the significance difference, which is given in Table 6.31.

H0: There is no significant differences in inbound logistics capability with the difference in vendor viability.

Table 6.31

Difference- vendor viability and Inbound Logistics (Kruskal Wallis Statistic)

Efficiency Level	N	Mean Rank	Chi square	P Value
High Efficiency	32	87.30	6.920	0.031*
Average Efficiency	93	79.63		
Poor Efficiency	35	63.23		
Total	160			

Note: * The mean difference is significant at the 0.05 level

With the Mean Rank and the asymptotic significance (2 tailed) P-value, the study interprets that there is a significant association between differences in efficiency of vendor viability and the inbound logistics operations χ^2 =6.920, P=0.031 (p<0.05). Hence, it is true to reject the null hypothesis. As the test result in Table 6.31 shows a significant association, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.32.

Table 6.32

Pairwise Comparisons: vendor viability and Inbound Logistics

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	16.396	11.298	1.451	.147
3.000-1.000	24.073	9.160	2.628	.009
2.000-1.000	-7.676	9.467	-0.811	.417

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

Form the mean rank derived from the Kruskal Wallis test result it was found that the inbound logistics performance is decreasing drastically in the lower efficiency level of the viability of the vendor comparing to the mean rank of the organisation's which adopted the vendors with average and high viability efficiency. But the pairwise comparison in the above Table 6.32 reveals a statistically significant association only in the pair of high and Poor vendor viability efficiency.Hence, there is associated with the variation in efficiency of other pairs, but it is not statistically significant.

B. **Vendor scalability and Inbound Logistics**

To check whether there is any difference in the inbound logistics of the firms in accordance with the variations in the efficiency in scalability of the ERP vendor the study formulated and tested the hypothesis below.

H0: There is no significant difference in inbound logistics capability with the differences in the vendor scalability.

Table 6.33

Differences - vendor scalability and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	67	101.52		
Average Efficiency	63	70.41	26.214	0.000*
Poor Efficiency	30	54.73		
Total	160			

Note: * The mean difference is significant at the 0.05 level

The test was done to prove whether the differences in the vendor scalability efficiency made any differences in the inbound logistics operations of the organisations using Mean Rank, test, and the asymptotic significance (2 tailed) P-value. The test result in the Table 6.33 reveals that χ^2 =6.920, P=0.031 (p<0.05). Hence, the study failed to accept the null hypothesis and identified that there is significant difference in inbound logistics operations with the difference in the efficiency of vendor scalability. As the test result shows a significant association, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.34.

Table 6.34

Pairwise Comparisons: vendor scalability and Inbound Logistics

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	15.679	10.247	1.530	.126
3.000-1.000	46.789	10.148	4.611	.000
2.000-1.000	31.110	8.107	3.837	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The Kruskal Wallis test in the above Table 6.34 reveals that the inbound logistics operations of the firms having vendors with high scalability efficiency are showing higher efficiency as the mean rank is higher than other firms. It is clear that the inbound logistics operational capability is decreasing drastically in the organisations with Poor vendor scalability efficiency level and average efficiency level comparing to the mean rank of organisation with higher efficiency as p<0.05, but even there is association in the pair with average and Poor efficiency, it is not statistically significant as p>0.05.

6.4.3 consultant evaluation and Inbound Logistics

A. Consultant Viability and Inbound Logistics

The following hypothesis is formulated and tested to check whether the differences in consultant viability made any difference in the inbound logistics capability of the organisation

H0: There is no significant difference in the inbound logistics capability with the difference in consultant viability.

Table 6.35

Differences- Consultant Viability and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	42	77.85	1.288	
Average Efficiency	36	86.13		0.525
Poor Efficiency	50	76.89		
Total	128			

The test 6.35 result reveals that χ^2 =1.288, P=0.525 (p>0.05), the study failed to reject the null hypothesis. Hence, there is no significant difference in inbound logistics capability due to the difference in consultant viability efficiency.

B. Consultant Scalability and Inbound Logistics

The study used Kruskal Wallis test to test the following formulated hypothesis to check whether the changes in consultant scalability made any changes in the inbound logistics capability of the organisation

H0: There is no significant difference in inbound logistics with the difference in consultant scalability.

Table 6.36

Difference- Consultant Scalability and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	39	118.10	63.794	
Average Efficiency	34	74.40		0.000*
Poor Efficiency	55	48.45		
Total	128			

The above test result in Table 6.36 is indicating that there is significant difference in the inbound logistics capability of the organisation as per the variations in the consultant scalability efficiency χ^2 =63.794, P=0.000 ($p<0.05$). Hence, the study failed to accept the null hypothesis. As the test result shows a significant association, it is relevant to carry out a pairwise comparison, which is exhibited in Table 6.37.

Table 6.37

Pairwise Comparisons: Consultant Scalability and Inbound Logistics

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	25.955	9.026	2.875	.004
3.000-1.000	69.655	8.809	7.907	.000
2.000-1.000	43.700	9.026	4.841	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table6.37 reveals a significant difference between all the three pairs as the $p<0.05$. The mean rank derived from the Kruskal Wallis test result in the Table is revealing that the inbound logistics capability of the organisation is much lower which opted the consultant having Poor scalability efficiency while comparing to the mean rank of consultant with higher scalability efficiency and average efficiency and also mean rank of inbound logistics is Poor in the case of Poor scalability consultant comparing to the average efficient.

6.4.4 Software Readiness and Inbound Logistics

A. ERP Package Vendor and Inbound Logistics

The study needs to test the changes in inbound logistics capability due to the differences in the vendor selected. For analysis purpose, the study categorized by the ERP package vendor into two. Hence, it is relevant to use the Mann-Whitney U statistic to test the below formulated hypothesis.

H0: There is no significant difference in the inbound logistics capability with the difference in the ERP package vendor.

Table 6.38

Difference: ERP Package Vendor and Inbound Logistics and (Mann-Whitney U statistic)

Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
SAP	120	80.53	2397.000	3217.000	-0.012	0.991
Others	40	80.43				
Total	160					

The test result in the above Table 6.38, the p-value> 0.05 and the test 'z' falls within the critical values z -1.96 and +1.96, the study failed to reject the null hypothesis. Hence, there is no significant difference between the ERP vendor selected and the inbound logistics.

B. Customisation Level and Inbound Logistics

The following hypothesis is formulated for testing the association between the differences in customization level for satisfying the business requirements and the inbound logistics.

H0: There is no significant difference in inbound logistics capability with the difference in customisation level.

Table 6.39

Difference: Customisation Level and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Zero customisation	49	77.72	2.702	0.440
Minor customisation (1-10%)	34	81.65		
Moderate customisation (11-25%)	46	91.79		
Major Customisation (26-50%)	31	75.00		
Total	160			

The test result in the Table 6.39 illustrates that $\chi^2 = 2.702$, P=0.440 ($p>0.05$), there is no evidence to accept the null hypothesis. Hence, there is no significant difference in the inbound logistics capability of the organisation due to the changes in the customisation level of the ERP software.

C. Consultancy Services and Inbound Logistics

The following hypothesis is formulated for testing the difference in the inbound logistics operation capability of adopters and non-adopters of consultancy services for ERP implementation.

H0: There is no significant difference in inbound logistics capability with the difference in consultancy services.

Table 6.40

Differences: Consultancy Services and Inbound Logistics (Kruskal Wallis Statistic)

CNTS	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
Adopted	128	79.16	1877.000	10133.000	-0.732	0.464
Not adopted	32	85.84				
Total	160					

The data in the table 6.40 failed to provide any result on the existence of significant difference in the inbound logistics operations due to the adoption and non-adoption of consultancy services for ERP implementation as $p>0.05$. Therefore, the study failed to reject the null hypothesis. Hence, there is no significant difference in inbound logistics capability and consultancy services.

D. Implementation Approaches and Inbound Logistics

The following hypothesis is formulated and tested to check whether there is any difference in the inbound logistics operation capability of the organisation with the difference in the ERP implementation approaches.

H0: There is no significant difference in inbound logistics capability with the difference in implementation approaches.

Table 6.41

Differences: Implementation Approaches and Inbound Logistics (Kruskal Wallis Statistic)

Implementation approaches	N	Mean Rank	Chi square	P Value
Big bang	94	78.99	0.801	0.670
Modules Wise	50	80.24		
Roll out	16	90.16		
Total	160			

The test was done to prove whether the differences in the implementation approaches adopted by the organisations made any difference in the inbound logistics operations, and it was found from the test result in the Table 6.41 that $p>0.05$, the study failed to reject the null hypothesis. Hence, there is no significant association between differences in implementation approaches adopted by the organisations and the inbound logistics operations.

6.4.5 Organisational Readiness and Inbound Logistics

A. Resource Mobilisation and Inbound Logistics

The following hypothesis is formulated and tested to understand whether the differences in resource mobilisation Efficiency in implementing an ERP system made any changes in the inbound logistics capability of the organisation

H0: There is no significant difference in inbound logistics capability with the difference in resource mobilisation efficiency.

Table 6.42

Differences: Resource Mobilisation and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	62	117.13	76.226	
Average Efficiency	49	73.88		0.000*
Poor Efficiency	49	40.78		
Total	160			

Note: * The mean difference is significant at the 0.05 level.

The test was done to prove whether the differences in the efficiency in resource mobilisation made any differences in the inbound logistics Operations of the organisation and it was found from the Table 6.42 that there is significant difference in resource mobilisation efficiency and the inbound logistics capability χ^2 =76.226, P=0.000 ($p<0.05$). Hence, it is true to reject the null hypothesis. As the test result shows a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.43.

Table 6.43

Pairwise Comparisons: Resource Mobilisation and Inbound Logistics

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	33.102	9.333	3.547	.000
3.000-1.000	76.354	8.830	8.647	.000
2.000-1.000	43.251	8.830	4.898	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.43 reveals a significant difference between all the three pairs of resource mobilisation efficiency as $p<0.05$. Form the mean rank it is clear that the inbound logistics Operation capability is very Poor in the organisation which is showing a poor efficiency in mobilizing the required resources for ERP implementation while comparing to average and highly efficient firms in resource mobilisation and also the inbound logistics Operation capability is Poor in the organisations with poor resource mobilisation efficiency level while comparing to the average resource mobilisation efficiency level.

B. BPR and Inbound Logistics

To test whether there exist any differences in the inbound logistics capability of the organisation due to the differences in their BPR efficiency, the study formulated the below hypothesis.

H0: There is no significant difference in inbound logistics capability with the difference in BPR efficiency.

Table 6.44

Difference: BPR and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	76.90	0.678	
Average Efficiency	76	80.14		0.713
Poor Efficiency	40	85.15		
Total	160			

The result of Kruskal-Wallis Test in the Table 6.44 reveals $p>0.05$, the study failed to reject the null hypothesis. Therefore, the study found that there is no significant difference in inbound logistics capability and BPR efficiency.

C. End-User Training and Inbound Logistics

The following hypothesis is formulated to test the significant difference in inbound logistics Capability of the organisation due to the difference in the training efficiency provided by the organisations to the ERP end users.

H0: There is no significant difference in inbound logistics capability with the difference in end-user training efficiency.

Table 6.45

Difference: End-User Training and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	70	76.64	1.482	
Average Efficiency	50	80.10		0.477
Poor Efficiency	40	87.76		
Total	160			

As $p>0.05$, the study failed to reject the null hypothesis. Hence, the result of Kruskal-Wallis Test in the above Table 6.45 reveals that there is no significant difference in inbound logistics capability as per the end-user training efficiency variations provided by the organisation.

6.4.6 Information System Readiness and Inbound Logistics

A. Data Migration and Inbound Logistics

The following hypothesis is formulated and tested to know if any significant difference in inbound logistics capability due to the difference in the data migration efficiency of different organisations.

H0: There is no significant difference in inbound logistics capability with the difference in data migration efficiency.

Table 6.46

Difference: Data Migration and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	49	75.20	1.149	
Average Efficiency	68	81.20		0.563
Poor Efficiency	43	85.43		
Total	160			

Since $p>0.05$, there is no evidence to reject null hypothesis. Hence, there is no significant difference in the inbound logistics Capabilities with the difference in the data migration efficiency as per the test result in Table 6.46.

B. System Testing and Inbound Logistics

To test the significant difference in the inbound logistics capability of the different organisations as per the variations in the new ERP system testing efficiency level, the study formulated and tested the below hypothesis.

H0: There is no significant difference in inbound logistics operation with the difference in system testing efficiency.

Table 6.47

Differences: System Testing and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	50	77.70	2.469	
Average Efficiency	67	76.54		0.291
Poor Efficiency	43	89.93		
Total	160			

The Kruskal Wallis test result in the Table 6.47 reveals that ($p>0.05$), the study failed to reject the null hypothesis. Therefore, the study found that there is no significant difference in the inbound logistics capability of the organisations as a result of difference in the new ERP system testing efficiency level of the selected organisations.

C. System Upgradation and Inbound Logistics

The following hypothesis is formulated to test the difference in the inbound logistics capability of the organisations due to the difference in the efficiency of upgrading the information system of the organisations

H0: There is no significant difference in inbound logistics capability with the difference in system upgradation efficiency.

Table 6.48

Difference: System Upgradation and Inbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	76.90	1.024	
Average Efficiency	76	79.35		0.599
Poor Efficiency	40	86.65		
Total	160			

The test was done to prove whether the differences in the efficiency in System Up gradation done by the organisations made any difference in the inbound logistics capability**.** Since (p>0.05), the study failed to reject the null hypothesis. Therefore, there exists no significant difference.

6.5 CSFs and Outbound Logistics

After analysing the differences in organisational capability and inbound logistics, the following section of the study is examining the difference in outbound logistics capability due to the difference in the selected CSFs.

6.5.1 Project Scope and Outbound Logistics

A. Physical Scope and Outbound Logistics The differences in the number of branches implemented with the ERP software made any difference in the outbound logistics capability of the organisation. The study needs to check whether these differences in the physical scope made any changes in the outbound logistics capability of different organisations. The following hypothesis is formulated to test the effect of number of ERP implemented branches on the outbound logistics of different organisations.

H0: There is no significant difference in the outbound logistics capability with the differences in the physical scope.

Table 6.49

Difference: Physical Scope and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Zero Branches	13	75.96	1.451	
1 to 10 Branches	81	80.24		.694
11 to 20 Branches	46	84.55		
Above 20 Branches	20	91.96		
Total	160			

The study failed to reject the null hypothesis as p>0.05, which indicates that there is no significant difference in outbound logistics of different organisations due to the differences in the physical scope.

B. Functional Scope and Outbound Logistics

The following hypothesis is developed and tested to check whether the differences in the functional scope which makes use of the ERP software in different organisations made any changes in its outbound logistics capability.

H0: There is no significant difference in outbound logistics capability with the difference in functional scope.

Table 6.50

Differences: Functional Scope and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Level O: Single Module	16	72.31	1.596	
Level 1: Core Module	42	83.73		0.660
Level 2: Level 1 + HR &/or PM	43	85.35		
Level 3: Level 2 + All preceding levels	59	76.89		
Total	160			

By applying the Kruskal Wallis test which is given in Table 6.50, the study identified that $p>0.05$, failed to reject the null hypothesis. Hence, the study found that the differences in the ERP modules implemented by different organisations did not make any significant differences in the operational excellence of the organisation.

6.5.2 Vendor Evaluation and Outbound Logistics

A. Vendor Viability and Outbound Logistics

The study formulated and tested the following hypothesis to identify that the differences in the viability efficiency of vendor made any differences in the outbound logistics capability of different organisations.

H0: There is no significant difference in the outbound logistics capability with the differences in vendor viability efficiency.

Table 6.51

Difference: vendor viability and ***Outbound Logistics*** *(Kruskal Wallis Statistic)*

	N	Mean Rank	Chi square	P Value
High Efficiency	32	90.63	3.108	0.211
Average Efficiency	93	75.37		
Poor Efficiency	35	84.89		
Total	160			

The test was done to prove whether the differences in the efficiency level in Vendor viability made any difference in the outbound logistic capability of different organisation and it was found that p>0.05, the study failed to reject the null hypothesis. Hence, there is no significant difference.

B. Vendor Scalability and Outbound Logistics

The following hypothesis is formulated and tested to understand whether the outbound logistics capability differs with differences in the scalability efficiency of ERP vendor.

H0: There is no significant difference in outbound logistics capability with the difference in vendor scalability.

Table 6.52

Differences: vendor scalability and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	67	76.49	0.918	0.632
Average Efficiency	63	82.98		
Poor Efficiency	30	84.27		
Total	160			

From the test in Table 6.52, it is clear that p>0.0, the study failed to reject the null hypothesis. Therefore, the study proved that there is no significant difference in the outbound logistics capability of the organisation with the differences in the scalability efficiency of the ERP vendors.

6.5.3 Consultant Evaluation and Outbound Logistics

A. Consultant Viability and Outbound Logistics

To check the changes happened in the outbound logistics capability of the organisation due to the changes in the viability efficiency of the consultant the study formulated and tested the hypothesis below

H0: There is no significant differences in the outbound logistics capability with the differences in consultant viability

Table 6.53

Difference: Consultant Viability and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	42	81.15	0.022	0.989
Average Efficiency	36	80.18		
Poor Efficiency	50	79.94		
Total	128			

The study failed to reject the null hypothesis as $p>0.05$ and hence proved that the differences in the efficiency level in consultant viability made no difference in the outbound logistics capability of different organisations.

B. Consultant Scalability and Outbound Logistics

The following hypothesis is formulated for testing the difference in outbound logistics capability when the scalability efficiency of consultant differs.

H0: There is no significant differences in the outbound logistics capability with the differences in consultant scalability.

Table 6.54

Difference: Consultant Scalability and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	39	86.24	2.466	0.291
Average Efficiency	34	72.56		
Poor Efficiency	55	81.98		
Total	128			

The test result in Table 6.54 shows that p>0.05, the study failed to reject the null hypothesis. Hence, the differences in the efficiency level in consultant scalability made no difference in the outbound logistics capabilities of different organisations.

6.5.4 Software Readiness and Outbound Logistics

A. ERP Package Vendor and Outbound Logistics

The following hypothesis is formulated to test whether the difference in the ERP vendor opted by different organsation made difference in the outbound logistics capability.

H0: There is no significant difference in the outbound logistics capability with the differences in ERP package vendor.

Table 6.55

Difference: ERP Package Vendor and Outbound Logistics (Mann-Whitney U statistic)

Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
SAP	120	85.15	2358.500	9618.500	0.167	0.867
Others	40	81.54				
Total	160					

As p>0.05, the study failed to reject the null hypothesis. Therefore, the study identified that there is significant difference in the outbound logistics capability with the differences in ERP package vendor.

B. Customisation Level and Outbound Logistics

The differences in the customisation level of the ERP software make differences in the outbound logistics capability of the organisation. To check the differences the study developed and tested the following hypothesis.

H0: There is no significant difference in the outbound logistics capability with the differences in the customisation level.

Table: 6.56

Difference: Customisation Level and Outbound Logistics (Kruskal Wallis Statistic)

Independent Variable	N	Mean Rank	Chi square	P Value
Zero customisation	49	80.48	01.593	0.661
Minor customisation (1-10%)	34	85.62		
Moderate Customisation (11-25%)	46	82.37		
Major Customisation (26-50%)	31	73.94		
Total	160			

Since the p>0.05 the study failed to reject the null hypothesis and interprets that the difference in the customization level of the ERP software make no significant difference in the outbound logistics capability of different organisations as per the test result in the Table 6.56.

C. **Consultancy Services and Outbound Logistics**

The outbound logistics capability of the organisation may differ with the difference in the organisation which opted or not opted the ERP consultant services. The following hypothesis is formulated and tested to find the differences.

H0: There is no significant difference in the outbound logistics capability with the adoption of consultant services.

Table 6.57

Difference: Consultancy Services and Outbound Logistics (Kruskal Wallis Statistic)

CNTS	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	P Value
Adopted	128	78.28	1764.000	10020.000	-1.236	0.216
Not adopted	32	89.38				
Total	160					

The study failed to reject the null hypothesis as the p-value> 0.05 and concludes that the data failed to provide any result on the existence of difference in the outbound logistics operations due to the adoption and non-adoption of consultancy services for ERP implementation.

D. Implementation Approaches and Outbound Logistics

The following hypothesis is formulated for testing the difference in the outbound logistics operation capability of the organisation with the difference in the ERP implementation approaches.

H0: There is no significant difference in the outbound logistics capability with the difference in implementation approaches.

Table 6.58

Differences: Implementation Approaches and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Big bang	94	78.91	1.343	0.511
Modules Wise	50	86.02		
Roll out	16	72.56		
Total	160			

From the test result in Table 6.58, the study found that p>0.05, the study failed to reject the null hypothesis. Therefore, there is no significant association between differences in implementation approaches and the outbound logistics capability of different organisations.

6.5.5 Organisational Readiness and Outbound Logistics

A. Resource Mobilisation and Outbound Logistics

To test whether the difference in the efficiency of mobilizing resources for the ERP implementation of different organisation made differences in the outbound logistics capability, the study formulated the following hypothesis.

H0: There is no significant difference in outbound logistics capability with the differences in the resource mobilisation efficiency.

Table 6.59

Differences: Resource Mobilisation and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	62	84.02	1.687	0.430
Average Efficiency	49	73.51		
Poor Efficiency	49	83.04		
Total	160			

The test was done to prove whether the differences in the efficiency level in resource mobilisation made any difference in the outbound logistics and it was found that $p>0.05$, the study failed to reject the null hypothesis. Hence, there exists no significant difference.

B. BPR and Outbound Logistics

The following hypothesis is formulated and tested to find the differences in outbound logistics capability with the difference in the efficiency level of the organisation to carry out the reengineering of business processes for implementing the new ERP system.

H0: There is no significant difference in outbound logistics capability with the difference in BPR efficiency.

Table 6.60

Difference: BPR and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	76.91	0.586	0.746
Average Efficiency	76	83.25		
Poor Efficiency	40	79.23		
Total	160			

The test was done to prove whether the differences in the BPR Efficiency made any difference in the outbound logistics operation efficiency, and it was found that there is no significant difference as the study failed to reject the null hypothesis due to $p>0.05$.

C. End-User Training and Outbound Logistics

The following hypothesis is formulated and tested to find the difference in the outbound logistics capability with the difference in the ERP end-user training efficiency.

H0: There is no significant difference in the outbound logistics capability with the difference in end-user training efficiency.

Table 6.61

Difference: End-User Training and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	70	81.88	1.027	0.598
Average Efficiency	50	75.34		
Poor Efficiency	40	84.54		
Total	160			

From the above test result in Table 6.61, it was found that $p>0.05$, the study failed to reject the null hypothesis. Hence, there is no significant difference in ERP end-user training and the outbound logistics capability of the firms.

6.5.6 Information System Readiness and Outbound Logistics

A. Data Migration and Outbound Logistics

The difference in the efficiency in the migration of data to the new ERP system may make differences in the outbound logistics capability. The following hypothesis is formulated and tested to check the differences.

H0: There is no significant difference in the outbound logistics capability with the difference in data migration efficiency.

Table 6.62

Difference: Data Migration and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	49	74.49	1.982	0.371
Average Efficiency	68	80.20		
Poor Efficiency	43	87.83		
Total	160			

The test was done to prove whether the differences in the data migration Efficiency made any significant difference in the outbound logistics capability, and it was found that $p>0.05$, the study failed to reject the null hypothesis. Hence, there are no such significant differences.

B. System Testing and Outbound Logistics

This section of the study formulated and tested the following hypothesis to find whether the differences in system testing efficiency made any significant difference in the outbound logistics capability of different organisations.

H0: There is no significant difference in outbound logistics with the difference in system testing.

Table 6.63

Difference: System Testing and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	50	78.64	0.260	
Average Efficiency	67	80.06		0.878
Poor Efficiency	43	83.35		
Total	160			

The test was done to check whether the differences in the efficiency in system testing done by the organisations made any differences in the outbound logistics capability and it was found that $p>0.05$, the study failed to reject the null hypothesis. Hence, there exists no significant differences.

C. System Upgradation and Outbound Logistics

The following hypothesis is formulated to test the association of difference in System Updation Efficiency with the outbound logistics operation efficiency of the organisation.

H0: There is no significant difference in outbound logistics Capability with the differences in system upgradation efficiency.

Table 6.64

Difference: System Upgradation and Outbound Logistics (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	76.91	0.500	
Average Efficiency	76	82.92		0.779
Poor Efficiency	40	79.85		
Total	160			

The test result in Table 6.64 reveals that p>0.05, the study failed to reject the null hypothesis. Hence, there is no significant difference in outbound logistics capability with the differences in system upgradation efficiency.

6.6. CSFs and Operational Excellence

The study analysed the difference in the overall organisational capability and the difference in inbound logistics and outbound logistics in the above sections. Now in this part the study tries to analyse the difference in operational excellence with the difference in the CSFs selected.

6.6.1 Project Scope and Operational Excellence

A. Physical Scope and Operational Excellence

The following hypothesis is formulated to test the effect of difference in the number of ERP implemented branches on the operational excellence of different organisations.

H0: There is no significant difference in operational excellence with the difference in physical scope.

Table 6.65

Difference: Physical Scope and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Zero Branches	13	107.38	6.954	
1 to 10 Branches	81	81.24		.073
11 to 20 Branches	46	78.62		
Above 20 Branches	20	64.35		
Total	160			

The Kruskal Wallis test result in the Table 6.65 reveals that p > 0.05, the study failed to reject the null hypothesis, which indicates that there is no significant variation in the operational excellence of organisations with difference in the number of ERP implemented branches.

B. Functional Scope and Operational Excellence

The study needs to check whether the difference in the number of modules implemented by different organisations made any differences in the operational excellence of the selected organisations. The following hypothesis is developed and tested to find the differences, if any.

H0: There is no significant difference in operational excellence with the difference in functional scope.

Table 6.66

Difference: Functional Scope and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Level O: Single Module	16	72.56	5.554	
Level 1: Core Module	42	87.08		0.135
Level 2: Level 1 + HR &/or PM	43	89.91		
Level 3: Level 2 + All preceding levels	59	71.11		
Total	160			

Since p>0.05, there is no evidence to reject null hypothesis. Hence, the test result in Table 6.66 indicates that the differences in the ERP modules implemented did not make any differences in the operational excellence of the organisation.

6.6.2 vendor evaluation and Operational Excellence

A. vendor viability and Operational Excellence

The following hypothesis is formulated for testing the differences in operational excellence due to the differences in the vendor viability efficiency of the selected samples.

H0: There is no significant difference in operational excellence with the difference in the vendor viability.

Table 6.67

Differences: vendor viability and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	32	76.33	2.935	0.230
Average Efficiency	93	85.59		
Poor Efficiency	35	70.80		
Total	160			

The test was done to prove whether the differences in the efficiency level in Vendor viability made any difference in the operational excellence and it was found that there is no significant difference as the study failed to reject the null hypothesis due to the p value greater than 0.05.

B. vendor scalability and Operational Excellence

To test whether the difference in efficiency of the vendor in making the ERP system scalable made any difference in the operational excellence of the selected organisation, the study formulated the following hypothesis and tested below.

H0: There is no significant difference in operational excellence with the difference in vendor scalability.

Table 6.68

Differences: vendor scalability and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	67	97.31	18.210	
Average Efficiency	63	74.03		0.000*
Poor Efficiency	30	56.53		
Total	160			

Note: * The mean difference is significant at the 0.05 level.

From the analysis Table 6.68, it was found that χ^2 =18.210, P=0.000 (p<0.05), the study failed to accept the null hypothesis. Hence, there is significant differences in efficiency in the operational excellence due to the differences in the scalability efficiency of the vendor. As the Kruskal Wallis test result shows a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the Table 6.69.

Table 6.69

Pairwise Comparisons: vendor scalability and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	17.498	10.240	1.709	.087
3.000-1.000	40.780	10.141	4.021	.000
2.000-1.000	23.282	8.102	2.874	.004

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

The above Table 6.69 is revealing a significant difference between the organisation having a Poor efficiency in vendor scalability and organisation with higher efficiency and also the organisation with vendors having an average efficiency in ERP scalability and organisations with vendors having higher scalability efficiency. The study also shows the insignificant difference between lower and average ERP scalability efficiency pairs. Form the mean rank it is clearer that the organizational capability is decreasing drastically in the average and poor vendor scalability efficiency level comparing to the mean rank of organisation with higher vendor scalability efficiency but even there is differences in the pair with average and lower vendor scalability efficiency, it is not statistically significant as $p>0.05$.

6.6.3 Consultant Evaluation and Operational Excellence

A. Consultant Viability and Operational Excellence

The following hypothesis is formulated and tested to analyse the significant difference in operational excellence due to the difference in ERP consultant viability efficiency of different organisations.

H0: There is no significant difference in operational excellence with the difference in consultant viability.

Table 6.70

Differences: Consultant Viability and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	42	78.17	0.291	0.864
Average Efficiency	36	82.66		
Low Efficiency	50	81.13		
Total	128			

The test was done to prove whether the differences in the efficiency level of ERP consultant viability made any difference in the operational excellence of the selected organisations and it was found that there is no significant difference as the study failed to reject the null hypothesis as p>0.05.

B. Consultant Scalability and Operational Excellence

The following hypothesis is formulated for testing the significant difference in operational excellence with the difference in consultant scalability Efficiency of the organisations selected for the study.

H0: There is no significant difference in operational excellence with differences in consultant scalability.

Table 6.71

Difference: Consultant Scalability and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	39	110.78	44.556	
Average Efficiency	34	78.41		0.000*
Poor Efficiency	55	52.12		
Total	128			

Note: * The mean difference is significant at the 0.05 level.

The test was done to prove whether the differences in the efficiency in evaluating the consultant scalability made any differences in the operational excellence of the organisation and it was found that there is significant difference, 2 (3) =44.556, P=0.000 ($p<0.05$). Hence it is true to reject the null hypothesis. As the test result in Table 6.71 shows a significant association it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.72.

Table 6.72

Pairwise Comparisons: Consultant Scalability and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	26.292	9.021	2.915	.004
3.000-1.000	58.664	8.803	6.664	.000
2.000-1.000	32.372	9.021	3.589	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

The above Table 6.72 reveals a significant difference between all the three pairs as the $p<0.05$. i.e., there is significant difference between the organisations with poor efficiency in consultant scalability and average efficiency, between average efficiency and high efficiency and between the organisation with poor consultant scalability efficiency and higher. The mean rank is revealing that the operational excellence of organisation with the consultant having Poor Scalability efficiency is very poor while comparing to the mean rank of organisation with higher efficiency and average efficiency and also mean rank of operational excellence is Poor in case of poor efficient firm comparing to the organisations having consultant with average efficiency in the scalability of ERP system.

6.6.4 Software Readiness and Operational Excellence

A. ERP Package Vendor and Operational Excellence

The study is required to find whether the difference in the ERP vendor selected by different organisation makes any significant difference in their operational excellence. To check the difference the study developed and tested the below hypothesis.

H0: There is no significant difference in operational excellence with the difference in ERP package vendor.

Table 6.73

Differences: ERP Package Vendor and Operational Excellence (Mann-Whitney U statistic)

Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
SAP	120	81.01	2338.500	3158.500	-0.243	0.808
Others	40	78.96				
Total	160					

From the above test result in the Table 6.73, it was observed that ($U = 2338.500$, $z = -0.243$, $p = 0.808$) p-value > 0.05 and the test ‘z’ falls within the critical values z-1.96 and +1.96, the study failed to reject the null hypothesis. Hence, the difference in the vendors selected for the ERP implementation by different organisations made no significant difference in their operational excellence.

B. Customisation Level and Operational Excellence

The level of customization of the new ERP software differs from one organisation to another as per their business requirements. The study needs to check whether such differences made any changes in the operational excellence of the selected organisations. The following hypothesis is formulated and tested to know the significant difference.

H0: There is no significant difference in operational excellence with the differences in customisation level.

Table 6.74

Differences: Customisation Level and Operational Excellence (Kruskal Wallis Statistic)

Independent Variable	N	Mean Rank	Chi square	P Value
Zero customisation	49	76.47	7.978	0.046*
Minor customisation (1-10%)	34	101.03		
Moderate Customisation (11-25%)	46	78.15		
Major Customisation (26-50%)	31	72.51		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The test was done to prove whether the differences in the customization level adopted by the organisations made any changes in the operational excellence, and it was found that there is significant difference as $\chi^2 = 7.978$, P=0.046* ($p<0.05$). Hence, the study fails to accept the H0. As the Kruskal Wallis test result shows the significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.75.

Table 6.75

Pairwise Comparisons: Customisation Level and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
Major Customisation (26-50%)-Zero Customisation	3.960	10.304	.384	.701
Major Customisation (26-50%)-Moderate Customisation (11-25%)	5.642	9.477	.595	.552
Major Customisation (26-50%)-Minor Customisation (1-10%)	28.522	10.594	2.692	.007*
Minor Customisation (1-10%) - Moderate Customisation (11-25%)	-1.682	10.441	-.161	.872*
Minor Customisation (1-10%) - Zero Customisation	24.562	11.464	2.142	.032*
Moderate Customisation (11-25%)- Zero Customisation	22.880	10.727	2.133	.033*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

Even there is significant difference in the operational excellence due to the difference in the level of customization adopted by different organisation, the result of the pairwise comparison of the three levels is indicating a significant difference in the operational excellence of the organisation as $p<0.05$. The mean rank reveals that the operational excellence is very high in those companies with minor ERP customization while comparing to the organisation adopted Major customization.

C. Consultancy Services and Operational Excellence

The organisation may or may not adopt the service of consultants while implementing the ERP system. The study is required to test whether the decision of taking or avoiding the consultancy service made any difference in the operational excellence of the organisation. The following hypothesis is formulated and tested to know the statistical difference.

H0: There is no significant difference in the operational excellence with the adoption of consultancy services.

Table 6.76

Difference: Consultancy Services and Operational Excellence (Mann Whitney U test)

CNTS	**N**	**Mean Rank**	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**p-value**
Adopted	128	78.03	1731.500	9987.500	-1.355	0.175
Not adopted	32	90.39				
Total	160					

It was observed from the Table 6.76, that the ($U = 1731.500$, $z = -1.355$, $p = 0.175$) as p-value > 0. 05 and the test ‘z’ falls within the critical values z-1.96 and +1.96, the study failed to reject the null hypothesis. Therefore, the study identified that the organisations which adopted the consultancy services and those who were not adopted the consultancy services for the ERP implementation made no significant difference in the operational excellence of the organisation.

D. Implementation Approaches and Operational Excellence

The following hypothesis is formulated for testing the difference in the operational excellence of the organisation with the difference in the ERP implementation approaches.

H0: There is no significant difference in operational excellence with the difference in implementation approaches.

Table 6.77

Difference: Implementation Approaches and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Big bang	94	84.37	1.703	0.427
Modules Wise	50	76.03		
Roll out	16	71.75		
Total	160			

The test was done to prove whether the differences in the implementation approaches adopted by the organisations were made any difference in the operational excellence, and it was found from the analysis from the Table 6.77 that $\chi^2 = 1.703$, P=0.427 (p>0.05), the study failed to reject the null hypothesis. Hence, there exists no significant difference in the operational excellence regarding implementation approaches.

6.6.5 Organisational Readiness and Operational Excellence

A. Resource Mobilisation and Operational Excellence

The following hypothesis is formulated and tested to identify the significant difference in operational excellence with the differences in the efficiency of mobilizing resources for the successful ERP implementation.

H0: There is no significant difference in operational excellence with the difference in resource mobilisation efficiency.

Table 6.78

Difference: Resource Mobilisation and Operational Excellence (Kruskal Wallis Statistic)

	N	**Mean Rank**	**Chi square**	**P Value**
High Efficiency	62	107.56	45.166	
Average Efficiency	49	78.40		0.000
Poor Efficiency	49	48.36		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The result of the Kruskal Wallis test in the Table 6.78 was indicating that there is significant difference in the operational excellence of the selected organisations with the difference in the efficiency in mobilizing resources for ERP implementation as $\chi^2 = 45.166$, P=0.000 ($p<0.05$). Hence, the study fails to accept the null hypothesis. As the result shows a significant difference, the study further made a pairwise comparison to know the significant difference in operational excellence between two different pairs from the identified three levels of resource mobilisation efficiency, which is given below.

Table 6.79

Pairwise Comparisons: Resource Mobilisation and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	30.041	9.327	3.221	.001*
3.000-1.000	59.207	8.824	6.710	.000*
2.000-1.000	29.167	8.824	3.305	.001*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.79 reveals a significant difference in the operational excellence of firms between the firms having a Poor efficiency in mobilizing resources and average efficiency in it, between Poor efficiency in resource mobilisation and high efficiency in it and between average resource mobilization efficiency and high efficiency in it. Form the mean rank it is clear that the operational excellence is very Poor in firms having a lower efficiency in resource mobilization while comparing to average and high efficiency level. All the three pairs are statistically significant as P<0.05.

B. BPR and Operational Excellence

The following hypothesis is formulated and tested to know whether the differences in the efficiency in reengineering the entire business operations of the selected organisations for the proper implementation of ERP system makes any difference in their operational excellence.

H0: There is no significant difference in operational excellence with the difference in BPR efficiency.

Table 6.80

Differences: BPR and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	96.58	39.131	
Average Efficiency	76	91.93		0.000
Poor Efficiency	40	41.10		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The test was done to prove whether the differences in the efficiency in BPR made any differences in the operational excellence of the organisation and it was found that χ^2 =39.131, P=0.000 (p<0.05), it is true to reject the null hypothesis. Hence there exists a significant difference in the operational excellence of the organisation. As the Kruskal Wallis test result in the above Table 6.80 indicates a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.81.

Table 6.81

Pairwise Comparisons: BPR and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	50.828	9.018	5.636	.000
3.000-1.000	55.480	10.085	5.501	.000
2.000-1.000	4.652	8.745	0.532	.595

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The Table 6.81 reveals a significant difference between two different pairs i.e., there is significant difference in the operational excellence between the pairs, Poor BPR efficiency and higher BPR efficiency and pairs with average BPR efficiency and Poor BPR efficiency as $p<0.05$. It also found that there is no significant difference in operational excellence with the firms having a Poor BPR efficiency and average BPR efficiency as the $p>0.05$. Form the mean rank it is clear that the operational excellence is very poor in the firms with Poor BPR efficiency level and average efficiency level comparing to the mean rank of organisation with higher and average BPR efficiency but even there is differences in the pair with average and lower BPR efficiency, it is not statistically significant as $p>0.05$.

C. End-User Training and Operational Excellence

The following hypothesis is formulated and tested to find whether the difference in the efficiency level of providing training to the users of a new ERP system in an organisation made any differences in their operational excellence.

H0: There is no significant difference in operational excellence with the difference in end-user training efficiency.

Table 6.82

Differences: End-User Training and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	70	86.76	4.496	
Average Efficiency	50	82.09		0.106
Poor Efficiency	40	67.55		
Total	160			

Since χ^2 =4.496, P=0.106 (p>0.05), there is no evidence to reject the null hypothesis. Hence, the test in Table 6.82 proved that there is no significant association between differences in User Training efficiency and the difference in the outbound logistics operations of the firms.

6.6.6 Information System Readiness and Operational Excellence

A. Data Migration and Operational Excellence

The following hypothesis is formulated and tested to find out the difference in the operational excellence as a result of the differences in the efficiency in the migration of data from the legacy system to the new ERP system.

H0: There is no significant difference in operational excellence with the differences in data migration efficiency.

Table 6.83

Differences: Data Migration and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	49	96.10	8.360	0.015
Average Efficiency	68	76.59		
Poor Efficiency	43	71.73		
Total	160			

Note: * The mean difference is significant at 0.05 level.

From the table 6.83 Kruskal Wallis test, it was found that χ^2 =8.360, P=0.015 ($p<0.05$), the study failed to accept the null hypothesis. Hence, there is a significant difference in the operational excellence of different organisation with the differences in the efficiency in migrating data to the new ERP system as. As the test result shows a significant difference. It is relevant to carry out a pairwise comparison which is exhibited in the following Table 6.84.

Table 6.84

Pairwise Comparisons: Data Migration and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	-4.865	8.995	-0.541	.589
3.000-1.000	24.374	8.651	2.818	.005
2.000-1.000	19.509	9.647	2.022	.043

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.84 exhibits a significant difference in the pair of organisations with higher efficiency in migrating data and the new ERP system with the organisations having average and poor data migration efficiency with higher efficiency as $p<0.05$. The mean rank generated from the Kruskal Wallis test showed a poor operational excellence with the firms having an average efficiency in data migration while comparing to the firms with high efficiency in it. Even there is difference in the operational excellence with the variation in efficiency of other pairs, but it is not statistically significant as $p>0.05$.

B. System Testing and Operational Excellence

The following hypothesis is formulated and tested to find whether there is any significant difference in the operational excellence of different organisations with the difference in their efficiency in testing the new ERP system before going live.

H0: There is no significant difference in operational excellence with the difference in system testing efficiency.

Table 6.85

Differences: System Testing and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	50	95.43	30.007	0.000*
Average Efficiency	67	90.40		
Poor Efficiency	43	47.71		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The test was done to prove whether the differences in the efficiency in system testing made any differences in the operational excellence and it was found that χ^2 30.007, P=0.000 ($p<0.05$), the study failed to accept the null hypothesis. Hence, there is a significant difference in operational excellence. As the Kruskal Wallis test result is showing a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.86

Table 6.86

Pairwise Comparisons: System Testing and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	42.694	9.021	4.733	.000
3.000-1.000	47.721	9.601	4.970	.000
2.000-1.000	5.027	8.627	0.583	.560

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.86, revealing a significant difference between two different pairs i.e., there is significant difference between the pairs with lower efficiency in system testing and with higher efficiency and pairs with average efficiency in system testing and with lower efficiency as $p<0.05$. Form the mean rank it is clear that the and operational excellence is very poor in the organisations with Poor system testing efficiency level comparing to the mean rank of organisation with higher and average efficiency but even there is difference in the pair with average and higher system testing efficiency, it is not statistically significant as $p>0.05$.

C. System Upgradation and Operational Excellence

The following hypothesis is formulated for testing the difference between Efficiency in System Up gradation and the operational excellence of the organisation.

H0: There is no significant difference in operational excellence with the difference in system upgradation efficiency.

Table 6.87

Differences: System Upgradation and Operational Excellence (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	96.58	40.165	0.000
Average Efficiency	76	92.21		
Poor Efficiency	40	40.56		
Total	160			

Note: * The mean difference is significant at 0.05 level.

From the test result in the above Table 6.87, it was found that χ^2 =40.165, P=0.000 ($p<0.05$), the study failed to accept null hypothesis. Hence, the differences in the efficiency in system upgradation made significant differences in the operational excellence of the selected organisations and as the Kruskal Wallis test result is showing a significant difference it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.88.

Table 6.88

Pairwise Comparisons: System Upgradation and Operational Excellence

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	51.648	9.018	5.727	.000
3.000-1.000	56.017	10.085	5.554	.000
2.000-1.000	4.369	8.745	0.500	.617

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

Since the $p<0.05$, the study identified from the pairwise comparison that there is significant difference between the operational excellence of those organisation which are highly efficient in ERP system upgradation and those organisations which showed a lower efficiency in that. The pairwise comparison in Table 6.88 also revealed a significant difference between the organisations which have average and poor efficiency in system upgradation with higher efficiency as the $p<0.05$. But even though there is difference in operational excellence between the organisation with higher and average efficiency in system upgradation, it is not statistically significant. From the mean rank the study found that as the system upgradation efficiency increases the operational excellence also improves.

6.7 CSFs and Decision Making

This section of the study is focusing on the difference in the decision-making capability of the organisation with the difference in the CSFs in the process of ERP implementation.

6.7.1 Project Scope and Decision Making

A. Physical Scope and Decision Making

The decision-making capability of an organisation may vary with the differences in the number of ERP implemented branches of an organisation. The study formulated the following hypothesis to test the effect of the number of ERP implemented branches on the decision-making capabilities of the organisation.

H0: There is no significant difference in the Decision-Making capability with the difference in physical scope.

Table 6.89

Differences: Physical Scope and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Zero Branches	13	91.31	5.043	0.169
1 to 10 Branches	81	85.75		
11 to 20 Branches	46	75.71		
Above 20 Branches	20	63.25		
Total	160			

The Kruskal Wallis test result in the Table 6.89 reveals that $\chi^2 = 0.169$, p = 0.169 (p>0.05), the study failed to reject the null hypothesis. Hence, there is no significant difference in the capability of the organisation in decision making due to the difference in the number of branches implementing ERP.

B. Functional Scope and Decision Making

From the survey, the study identified that different organisations implemented different ERP modules to satisfy their requirements. Now the study is testing whether these differences in the functional scope made any variations in the decision-making capability of the organisation. The following hypothesis is developed to test the effect of the difference in functional scope on the decision-making capability of the organisation.

H0: There is no significant difference in decision making capability with the difference in functional scope

Table 6.90

Differences: Functional Scope and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Level O: Single Module	16	68.88	3.436	
Level 1: Core Module	42	82.52		0.329
Level 2: Level 1 + HR &/or PM	43	89.60		
Level 3: Level 2 + All preceding levels	59	75.58		
Total	160			

The Kruskal Wallis test result in the Table 6.90 revealed that $\chi^2 = 3.436$, P=0.329 (p>0.05), the study failed to reject the null hypothesis. Therefore, the study identified that there is no statistically significant difference in the Decision-Making capability with the differences in ERP modules implemented by different organisations.

6.7.2 Vendor Evaluation and Decision Making

A. Vendor Viability and Decision Making

ERP vendor viability and its effect on the decision-making capability of the organisation is one of the CSFs in the process of ERP implementation. It is required to test whether the difference in the viability of different ERP vendors made any difference in the decision-making capability of the organisations. The following hypothesis is formulated and tested to identify any significant difference in the decision making.

H0: There is no significant difference in decision making capability with the difference in vendor viability.

Table 6.91

Differences: Vendor Viability and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	32	79.30	5.414	0.067
Average Efficiency	93	86.61		
Poor Efficiency	35	65.36		
Total	160			

From the test, the study found that χ^2 =5.414, P=0.067 (p>0.05), the study failed to reject the null hypothesis. Hence, there exists no significant difference in the Decision-Making Capability with the differences in Vendor viability.

B. vendor scalability and Decision-Making

The following hypothesis is formulated and tested to find the significant difference in the decision-making capability of the organisation due to the difference in vendor scalability.

H0: There is no significant difference in decision making capability with the difference in vendor scalability.

Table 6.92

Difference: VDS and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	67	99.63	22.384	0.000*
Average Efficiency	63	72.06		
Poor Efficiency	30	55.50		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The test result in the above Table 6.92 revealed that χ^2 =22.384, P=0.000 (p<0.05), the study failed to accept the null hypothesis. Hence, there exists significant difference in the Decision-Making Capability with the differences in vendor scalability. As the Kruskal Wallis test result indicates a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.93.

Table 6.93

Pairwise Comparisons: vendor scalability and Decision Making

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	16.563	10.245	5.727	.000*
3.000-1.000	44.127	10.146	5.554	.000*
2.000-1.000	27.563	8.105	0.500	.617

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.93 is revealing a significant difference in two different pairs i.e., there is significant difference in the Decision-Making capability between the pairs with Poor vendor scalability efficiency and higher efficiency and pairs, average and high efficiency but there is no significant difference in decision making capabilities of organisation with lower and average vendor scalability efficiency pairs. Form the mean rank it is clear that the organizational capability is decreasing drastically in the Poor vendor scalability efficiency level and average efficiency level comparing to the mean rank of organisation with higher vendor scalability efficiency but even there is association in the pair with average and lower efficiency, it is not statistically significant as $p>0.05$.

6.7.3 Consultant Evaluation and Decision Making

A. Consultant Viability and Decision Making

The following hypothesis is formulated and tested to check the significant difference in the Decision-Making capability of the organisation, due to the difference in the viability of ERP consultant.

H0: There is no significant difference in decision making capability with the difference in consultant viability.

Table 6.94

Differences: Consultant Viability and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	42	80.27	1.853	0.396
Average Efficiency	36	86.11		
Poor Efficiency	50	73.20		
Total	128			

Since p>0.05, there is no evidence to reject null hypothesis. Hence, there is no significant difference in the capability of decision making by different organisations due to the differences in the consultant viability.

B. Consultant Scalability and Decision Making

The following hypothesis is formulated and tested to find out the difference in decision making capability due to the difference in the scalability efficiency of consultant adopted by different organisations.

H0: There is no significant difference in decision making capability with the difference in consultant scalability

Table 6.95

Differences: Consultant Scalability and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	39	117.20	60.546	0.000*
Average Efficiency	34	74.33		
Poor Efficiency	55	49.41		
Total	128			

Note: * The mean difference is significant at 0.05 level.

The test in the above Table 6.95 is done to know whether the differences in the efficiency in consultant scalability made any differences in the Decision-Making Capability of the organisation and it is found that there is significant difference as χ^2 =60.546, P=0.000 (p<0.05). Hence, the study failed to accept the null hypothesis. As the Kruskal Wallis test result indicates a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table.

Table 6.96

Pairwise Comparisons: Consultant Scalability and Decision Making

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	24.921	9.025	2.761	.006*
3.000-1.000	67.791	8.807	7.697	.000*
2.000-1.000	42.870	9.025	4.750	.000*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.96 reveals a significant difference between all the three pairs as the $p<0.05$. i.e., there is a significant difference in decision making capability of the organisations between all the three pairs of efficiency. The mean rank is revealing that the Decision-Making Capability of organisation is very poor having consultant with poor scalability efficiency while comparing to the mean rank of organisation with higher Consultant scalability efficiency and average efficiency and also mean rank of Decision-Making Capability is poor in case of organisation having consultant with poor scalability efficiency while comparing to the firms adopted consultant having average scalability efficiency.

6.7.4 Software Readiness and Decision Making

A. ERP Package Vendor and Decision Making

The study needs to test whether the difference in the ERP vendor adopted by different organisation made any variations in the decision-making capability of the organisations, The study formulated and tested the below hypothesis to find the difference.

H0: There is no significant difference in the Decision-Making capability with the differences in ERP package vendor.

Table 6.97

Differences: ERP Package Vendor and Decision Making (Mann-Whitney U statistic)

Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
SAP	120	80.45	2394.000	9654.000	-0.024	0.981
Others	40	80.65				
Total	160					

Table 6.97 provides the U statistic, test, and the asymptotic significance (2 tailed) P-value. It was observed that the p-value >0.05 and the test 'z' falls within the critical values z-1.96 and +1.96, the study failed to reject H0. Therefore, the study identified that the differences in the vendors selected for the ERP implementation made no statistically significant differences in the Decision-Making capability of organisations.

B. Customisation Level and Decision Making

The difference in the customization of ERP software adopted by different organisation may influence the capability of the organisation in its decision making. The study formulated and tested the following hypothesis to identify the significant difference.

H0: There is no significant difference in decision making capability with the differences in customisation level.

Table 6.98

Differences: Customisation Level and Decision Making (Kruskal Wallis Statistic)

Independent Variable	N	Mean Rank	Chi square	P Value
Zero customisation	49	81.03	1.979	0.577
Minor customisation (1-10%)	34	83.88		
Moderate Customisation (11-25%)	46	89.05		
Major Customisation (26-50%)	31	75.77		
Total	160			

Form the test result in the Table 6.98, it was found that χ^2 = 1.979, P=0.577 ($p>0.05$), the study failed to reject the null hypothesis. Hence, there is no significant difference in the in the decision-making capability with the differences in the customization level of the ERP software adopted by different organisations.

C. Consultancy Services and Decision Making

The following hypothesis is formulated and tested to identify the significant difference in decision making capability of the organisation due to the adoption and non-adoption of consultant service in the process of ERP implementation.

H0: There is no significant difference in decision making capability with the adoption of consultancy services.

Table 6.99

Differences: Consultancy Services and Decision Making (Kruskal Wallis Statistic)

CNTS	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
Adopted	128	82.50	1984.000	10240.000	0.274	0.784
Not adopted	32	80.00				
Total	160					

It is observed from the Table 6.99 that the organisations which adopted the consultancy services and those who did not adopted the consultancy services for the ERP implementation is not making any significant difference in the Decision-Making capability of the organisation as they are not statistically significant (U = 1984.000, z = -0.274, p = 0.784) as p-value > 0. 05 the test 'z' falls within the critical values z-1.96 and +1.96. Therefore, the study failed to reject the null hypothesis.

D. Implementation Approaches and Decision Making

The following hypothesis is formulated and tested to observe the significant difference in the organisations decision making capability due to the different implementation approaches adopted by different manufacturing units.

H0: There is no significant difference in decision making capability with the difference in implementation approaches.

Table 6.100

Difference: Implementation Approaches and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Big bang	94	78.90	0.284	0.868
Modules Wise	50	82.42		
Roll out	16	83.88		
Total	160			

From the test result in the above Table 6.100, the study identified that χ^2 = 0.284, P=0.868 (p>0.05) the study failed to reject the null hypothesis. Hence, there is no significant difference in the Decision-Making capability of organisations with the difference in the ERP implementation approaches adopted.

6.7.5 Organisational Readiness and Decision Making

A. Resource Mobilisation and Decision Making

The following hypothesis is formulated and tested to identify the significant difference in decision making capability of firms due to the difference in the capability of mobilizing resources for successful ERP implementation.

H0: There is no significant difference in decision making capability with the difference in resource mobilisation efficiency.

Table 6.101

Differences: Resource Mobilisation and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	62	115.38	73.534	0.000*
Average Efficiency	49	76.98		
Poor Efficiency	49	39.89		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The test in the above Table 6.101 was done to prove whether the differences in the efficiency in resource mobilisation made any differences in the Decision-Making Capability of the organisation and it was found that there is significant difference as χ^2 =73.534, P=0.000 ($p<0.05$). Hence the study failed to accept the null hypothesis. As the Kruskal Wallis test result indicates a significant difference, it is relevant to carry out a pairwise comparison, which is exhibited in the following Table 6.102.

Table 6.102

Pairwise Comparisons: Resource Mobilisation and Decision Making

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	37.092	9.331	3.975	.000*
3.000-1.000	75.491	8.828	8.551	.000*
2.000-1.000	38.399	9.828	4.350	.000*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.102 reveals a significant difference in decision making capability with the difference in the efficiency level of mobilizing resources by comparing all the three pairs of efficiency. Form the mean rank it is identified that the Decision-Making Capability is very poor in the organisations with poor efficiency in resource mobilisation while comparing to average and high efficiency level and also the Decision-Making Capability is poor in the units with poor efficiency in resource mobilisation while comparing to the average efficiency level. All the three pairs are statistically significant as $P<0.05$

B. BPR and Decision Making

The following hypothesis is formulated and tested to identify the significant difference in the capability of the organisations in making decisions with the difference in the efficiency of the organisation in reengineering the business process for a successful ERP implementation.

H0: There is no significant difference in decision making capability with the difference in BPR efficiency.

Table 6.103

Differences: BPR and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	82.16	0.372	0.830
Average Efficiency	76	81.28		
Poor Efficiency	40	76.93		
Total	160			

Since $p>0.05$ in the above Kruskal Wallis test result in Table 6.103, the study failed to reject the null hypothesis. Hence, the test proved that the differences in the BPR Efficiency made no significant differences in the Decision-Making capability of the organisations.

C. End-User Training and Decision Making

Organisations need to provide efficient training to the end users of the new ERP system. The study needs to know whether the efficiency of end user training made any significant difference in the decision-making capability of the organization.

H0: There is no significant difference in decision making capability with the difference in end-user training efficiency.

Table 6.104

Differences: End-User Training and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	70	84.75	0.464	0.793
Average Efficiency	50	79.64		
Poor Efficiency	40	78.69		
Total	160			

The test result in the above Table 6.104 indicates that $p>0.05$, the study failed to reject the null hypothesis. Hence, the test proved that there is no significant difference in the capability of decision making by different organisation with the difference in the efficiency of the training provided to end users of ERP.

6.7.6 Information System Readiness and Decision Making

A. Data Migration and Decision Making

The following hypothesis is formulated and tested to identify the significant difference in the capability of decision making by the manufacturing units due to the difference in the efficiency in migrating the data from the legacy system to the new ERP system.

H0: There is no significant difference in decision making capability with the difference in data migration efficiency.

Table 6.105

Differences: Data Migration and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	49	77.14	1.678	0.432
Average Efficiency	68	78.00		
Poor Efficiency	43	88.28		
Total	160			

The test result in the above Table 6.105 is revealing an insignificant difference in the capability of decision making by the organisations with difference in the efficiency of migrating data into the new ERP system as χ^2 =1.678, P=0.432 (p>0.05), hence the study failed to reject the null hypothesis

B. **System Testing and Decision Making**

The entire ERP system may become a failure if there is inefficiency in testing the new ERP system before going live. Here, the study is testing the significant difference in the decision-making capability of the organisation with the difference in the efficiency of testing the new ERP system. The study developed and tested the following hypothesis to find the significant difference.

H0: There is no significant difference in decision making capability with the difference in system testing efficiency.

Table 6.106

Differences: System Testing and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	50	75.64	1.290	0.525
Average Efficiency	67	80.25		
Poor Efficiency	43	86.53		
Total	160			

The test in the above Table 6.106 was done to prove whether the differences in the system testing efficiency make any significant difference in the Decision-Making capability, and it was found that there is no significant difference as □2 =1.290, P=0.525 (p>0.05), hence the study failed to reject the null hypothesis.

C. System Upgradation and Decision Making

Even after successful implementation, it is essential to upgrade the implemented ERP system efficiently to make the organisation more capable. The study needs to identify whether the difference in the efficiency of upgrading the ERP system made any difference in the decision-making capability of the organisation. The study developed and tested the following hypothesis to find the significant difference.

H0: There is no significant difference in decision making capability with the difference in system upgradation efficiency.

Table 6.107

Differences: System Upgradation and Decision Making (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	76.93	0.370	0.831
Average Efficiency	76	82.12		
Poor Efficiency	40	81.35		
Total	160			

Since p>0.05, there is no evidence to reject null hypothesis. Hence, there is no significant difference in the Decision-Making capability with the differences in the System Up gradation efficiency of the enterprises.

6.8 CSFs and Strategic Impact

The study made the interpretations on the difference in overall organizational capability and the difference in inbound logistics, outbound logistics and Decision-Making capability and the variations in operational excellence of the ERP implemented companies. Now, in this section the study needs to analyse the difference in the strategic impact due to the difference in the CSFs in the process of ERP implementation.

6.8.1 Project Scope and Strategic Impact

The significant difference in strategic impact with the difference in the physical and functional scope is tested below.

A. Physical Scope and Strategic Impact

The organisations need to adopt different strategies for the survival of the business and to become competitive. The study is required to test whether the difference in ERP implementation branches of the selected organisations made any impact on the strategies adopted by them. The following hypothesis is developed and tested to know the significant difference.

H0: There is no significant difference in the strategic impact with the difference in physical scope.

Table 6.108

Differences: Physical Scope and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Zero Branches	13	92.88	2.188	.534
1 to 10 Branches	81	81.33		
11 to 20 Branches	46	73.72		
Above 20 Branches	20	85.58		
Total	160			

From the Table 6.108, it is found that $\chi^2 = 2.188$, $p = 0.534$ ($p>0.05$), hence the study failed to reject the null hypothesis i.e., there is no significant difference in the organisational strategies with the difference in the number of ERP implemented branches of different organisations.

B. Functional Scope and Strategic Impact

The requirement, capital and many other factors of the organisation lead to the selection of ERP modules. Hence, it is mostly different from one organisation to another organisation. Here, the study is checking whether the variations in the modules implemented by the organisation made any difference on the strategies of the organisation. The following hypothesis is developed and tested to identify the differences in the strategic impact.

H0: There is no significant difference in the strategic impact with the difference in the functional scope.

Table 6.109

Differences: Functional Scope and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
Level O: Single Module	16	77.06	2.059	
Level 1: Core Module	42	80.02		0.560
Level 2: Level 1 + HR &/or PM	43	88.69		
Level 3: Level 2 + All preceding levels	59	75.81		
Total	160			

The Kruskal Wallis test mentioned in the above Table 6.109 reveals that $p>0.05$, the study failed to reject the null hypothesis. Therefore, the test proved that the differences in the ERP modules implemented by different organisation made no significant differences in the strategic impact of ERP implementation.

6.8.2 vendor evaluation and Strategic Impact

A. vendor viability and Strategic Impact

The following hypothesis is formulated and tested to find out the significant difference in the strategic impact of the organisation due to the difference in vendor viability.

H0: There is no significant difference in strategic impact with the differences in vendor viability.

Table 6.110

Differences: vendor viability and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	32	90.78	5.616	0.060
Average Efficiency	93	82.69		
Poor Efficiency	35	65.27		
Total	160			

Since, χ^2 =5.616, P=0.060 ($p>0.05$), the study failed to reject the null hypothesis. Hence, from the Kruskal Wallis test in Table 6.110 showed that the differences in the viability of the vendor made no significant difference in the strategic impact of ERP.

B. vendor scalability and Strategic Impact

The study developed the following hypothesis and tested to identify the differences in the strategic impact of ERP with the differences in the vendor scalability.

H0: There is no significant difference in strategic impact with the difference in the vendor scalability.

Table 6.111

Differences: vendor scalability and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	67	84.20	0.992	0.609
Average Efficiency	63	82.08		
Poor Efficiency	30	76.31		
Total	160			

The test in the above Table 6.111 was done to prove whether the differences in the vendor scalability made any difference in the Strategic impact of ERP and it was found that there is no significant difference as χ^2 =5.616, P=0.060 (p>0.05), hence the study failed to reject the null hypothesis.

6.8.3 consultant evaluation and Strategic Impact

Consultant viability and scalability were used to evaluate the consultant by assessing its strategic impact.

A. Consultant Viability and Strategic Impact

The following hypothesis is developed and tested to interpret the difference in the strategic impact of ERP due to changes in the viability of consultant.

H0: There is no significant difference in the strategic impact with the difference in consultant viability.

Table 6.112

Differences: Consultant Viability and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	42	84.69	3.255	0.196
Average Efficiency	36	83.98		
Poor Efficiency	50	69.30		
Total	128			

The test result in the above Table 6.112 is indicating that χ^2 =3.255, P=0.196 (p>0.05), the study failed to reject the null hypothesis. Hence, the study found that there is no significant difference in the strategic impact of ERP implementation with the difference in the viability of the consultant.

B. Consultant Scalability and Strategic Impact

The strategic impact ERP implementation may vary from one organisation to another due to the variations in the scalability of the vendor. The study needs to identify whether the difference in the scalability of the consultant made any difference in the strategic impact of ERP implementation. The following hypothesis is formulated to test the significant difference.

H0: There is no significant difference in strategic impact with the difference in the consultant scalability.

Table 6.113

Differences: Consultant Scalability and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	39	85.70	1.719	0.423
Average Efficiency	34	81.25		
Poor Efficiency	55	73.96		
Total	128			

It was found from the test result in the above Table 6.113 that χ^2 =1.719, P=0.423 (p>0.05), hence the study failed to reject the null hypothesis. Therefore, from the Kruskal Wallis test the study interpreted that the differences in the consultant scalability made no significant differences in the strategic impact of ERP implementation.

6.8.3 Software Readiness and Strategic Impact

A. ERP Package Vendor and Strategic Impact

The following hypothesis is formulated and tested to identify whether the difference in the vendor selected for the ERP implementation made significant difference in the strategic impact of ERP implementation.

H0: There is no significant difference in strategic impact with the differences in the ERP package vendor.

Table 6.114

Differences: ERP Package Vendor and Strategic Impact (Mann-Whitney U statistic)

Vendor	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
SAP	120	77.64	2057.000	9317.000	-1.358	0.175
Others	40	89.08				
Total	160					

Table 6.114 provides the U statistic, test, and the asymptotic significance (2 tailed) P-value. It is observed that the difference in the vendors selected for the ERP implementation and its effect on the strategic impact (U = 2057.000, z = -1.358, p = 0.175) are not statistically significant as p-value >0.05 and the test ‘z’ falls within the critical values z-1.96 and +1.96. Hence, the study failed to reject the null hypothesis. It means the data is not providing any result on the existence of difference in the performance of strategic impact as the ERP package Vendors differ from one organisation to another.

B. Customisation Level and Strategic Impact

The difference in the customization level adopted by the organisation may cause significant differences in the strategic impact of ERP implementation. Therefore, the study developed and tested the following hypothesis to interpret the significant difference of strategic impact due to the variations in the customisation level of the ERP software.

H0: There is no significant difference in strategic impact with the difference in customisation level.

Table 6.115

Differences: Customisation Level and Strategic Impact (Kruskal Wallis Statistic)

Independent Variable	N	Mean Rank	Chi square	P Value
Zero customisation	49	78.58	1.455	0.693
Minor customisation (1-10%)	34	88.13		
Moderate Customisation (11-25%)	46	80.79		
Major Customisation (26-50%)	31	75.85		
Total				

The above test result in the Table 6.115 was made to identify whether the differences in the customization level adopted by the organisations made any significant difference in the strategic impact of ERP implementation and it was found that there is no significant difference as χ^2 = 1.455, P=0.0.693 (p>0.05). Hence, the study fails to reject the null hypothesis.

C. Consultancy Services and Strategic Impact

The following hypothesis is formulated and tested to identify the significant difference in the Strategic impact due to the adoption and non-adoption of consultancy services for the efficient implementation of ERP.

H0: There is no significant difference in strategic impact with the adoption of consultancy services.

Table 6.116

*Differences: **C**onsultancy Services and Strategic Impact (Kruskal Wallis Statistic)*

CNTS	N	Mean Rank	Mann-Whitney U	Wilcoxon W	Z	p-value
Adopted	128	83.73	1635.000	2163.000	-1.770	0.077
Not adopted	32	67.59				
Total	160					

Table 6.116 provides the U statistic, test, and the asymptotic significance (2 tailed) P-value. As (U = 1635.000, z = -1.770, p = 0.077) p-value > 0.05 and the test

'z' falls within the critical values z-1.96 and +1.96, the study failed to reject the null hypothesis. The result revealed the non-existence of any significant difference in the strategic impact due to the adoption and non-adoption of consultancy services for ERP implementation. It is observed that the organisations which adopted the consultancy services and those who did not adopt the consultancy services for the ERP implementation made no significant differences in the strategic impact of ERP.

D. Implementation Approaches and Strategic Impact

There are different types of ERP implementation approaches adopted by the manufacturing units. The study likes to know whether the difference in the implementation approaches made any significant difference in the strategic impact of ERP.

H0: There is no significant difference in strategic impact with the difference in implementation approaches.

Table 6.117

Differences: Implementation Approaches and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	p
Big bang	94	81.43	0.214	0.899
Modules Wise	50	78.06		
Roll out	16	82.69		
Total	160			

The test in the above Table 6.117 shows that p>0.05, hence the study failed to reject the null hypothesis. Therefore, the test result indicates that the differences in the implementation approaches adopted by the organisations made no significant difference in the strategic impact of ERP implementation.

6.8.4 Organisational Readiness and Strategic Impact

A. Resource Mobilisation and Strategic Impact

Mobilisation of resources is an unavoidable factor in the ERP implementation process. Many organisations are very efficient in resource mobilisation while some may not. The study is required to test whether the difference in the efficiency of the organisation to mobilise resources made any significant difference in the strategic impact of ERP implementation. To test the significant difference, the study generates the following hypothesis and is later tested.

H0: There is no significant difference in strategic impact with the difference in resource mobilisation efficiency.

Table 6.118

Differences: Resource Mobilisation and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	62	94.37	9.625	0.008*
Average Efficiency	49	74.92		
Poor Efficiency	49	68.53		
Total	160			

Note: * The mean difference is significant at 0.05 level.

From the Kruskal Wallis test in the above Table 6.118, it was found that the differences in the efficiency in resource mobilisation made significant difference in the strategic impact of ERP implementation as $p<0.05$, hence the study failed to accept the null hypothesis. As the test result shows a significant difference, it is relevant to carry out a pairwise comparison, which is given in the following Table 6.119.

Table 6.119

Pairwise Comparisons: Resource Mobilisation and Strategic Impact

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	6.388	9.318	0.685	.493
3.000-1.000	25.840	8.816	2.931	.003*
2.000-1.000	19.453	8.816	2.206	.027*

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The above Table 6.119 reveals a significant difference in strategic impact of ERP implementation, only in between the organisations with poor and average resource moblisation efficiency with high efficiency as $p<0.05$. Form the mean rank the strategic impact of ERP is very Poor in the organisations having poor efficiency in mobilizing resources for ERP implementation while comparing to the organisations with high efficiency in resource mobilization. Even there is difference in the strategic impact of ERP implementation while comparing firms with poor resource mobilsation efficiency and average efficiency.

B. BPR and Strategic Impact

The study is required to identify whether the difference in the efficiency level of the selected organisations in the process of BPR for the effective implementation of the new ERP system made a difference in the strategic impact of ERP implementation. To find out the differences the study generated the following hypothesis and tested below.

H0: There is no significant difference in strategic impact with the difference in BPR efficiency.

Table 6.120

Difference: BPR and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	86.41	20.746	0.000*
Average Efficiency	76	92.07		
Poor Efficiency	40	52.03		
Total	160			

Note: * The mean difference is significant at 0.05 level.

From the test result in the above Table 6.120, it was identified that χ^2 =920.746, P=0.000 ($p<0.05$). Hence the study failed to accept the null hypothesis. The result indicates that the differences in the efficiency in BPR made significant differences in the strategic impact of ERP implementation. As the test result shows a significant difference, the study conducts a pairwise comparison as given in the below Table 6.121.

Table 6.121

Pairwise Comparisons: BPR and Strategic Impact

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	34.384	10.077	3.412	.001
3.000-1.000	40.041	9.010	4.444	.000
2.000-1.000	-5.657	8.737	-.647	.517

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The pairwise comparison in the above Table 6.121 shows a significant difference in the strategic impact of ERP implementation between the organisation having poor efficiency in BPR and the organisation having a higher BPR efficiency. The result also indicating a significant difference in the strategic impact among the organisations with average BPR efficiency and the organsiations with poor BPR efficiency. In both cases the $p<0.05$. From the mean rank it is clear that the Strategic impact is very poor in the organisations which shown a poor BPR efficiency while compared to the mean rank of organisation with higher and average BPR efficiency.

Even if there is a difference in the strategic impact of the organisations with average and poor BPR efficiency, it is not statistically significant as $p>0.05$.

C. End-User Training and Strategic Impact

The difference in the efficiency of providing training to the end users of ERP causes differences in the strategic impact of ERP implementation. The study formulated and tested the following hypothesis to identify the significant difference in strategic impact of ERP implementation due to the difference in the efficiency of providing training to the users of ERP systems.

H0: There is no significant difference in strategic impact with the difference in end-user training efficiency.

Table 6.122

Differences: End-User Training and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	70	86.41	10.296	0.006
Average Efficiency	50	67.01		
Poor Efficiency	40	74.89		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The Kruskal Wallis Statistic in the above Table 6.122 was done to identify whether the differences in the efficiency in User Training made any differences in the strategic impact of ERP implementation and it was found that $\chi^2 = 10.296$, P=0.006 ($p<0.05$), the study failed to accept null hypothesis. Hence, there is a significant difference in the strategic impact with the differences in end-user training efficiency. As the test result shows a significant difference, the study made a pairwise comparison below.

Table: 6.123

Pairwise Comparisons: End-User Training and Strategic Impact

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	-7.878	9.784	-.805	.421
3.000-1.000	18.455	9.142	2.019	.044
2.000-1.000	26.333	8.541	3.083	.002

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The Table 6.123 is revealing a significant difference in the strategic impact of ERP implementation between the organisations having high efficiency in providing end user training to organisations having an average efficiency and poor efficiency in providing end user training as $p<0.05$. The mean rank generated from the Kruskal Wallis test result shows a Poor strategic impact among the firms which provided an average end user training while comparing to the organisation which provided a highly efficient end-user training. Even if there is difference in the strategic impact of organisation with the variation in training efficiency of other pairs, it is not statistically significant as $p>0.05$.

6.8.6 Information System Readiness and Strategic Impact

A. Data Migration and Strategic Impact

The following hypothesis is formulated and tested to identify the significant difference in the strategic impact of ERP as a result of the differences in the efficiency of migrating data to the new ERP system.

H0: There is no significant difference in strategic impact with the difference in data migration efficiency.

Table 6.124

Differences: Data Migration and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	49	91.97	5.273	0.072
Average Efficiency	68	78.75		
Poor Efficiency	43	70.20		
Total	160			

As the test result in the above Table 6.124 shows that χ^2 =5.273, P=0.072 (p>0.05), the study failed to reject the null hypothesis. Hence, the study established that there is no significant difference in the strategic impact of ERP with the differences in the efficiency in data migration.

B. System Testing and Strategic Impact

The significant difference in the strategic impact of ERP due to the difference in the efficiency in testing the new ERP system is analysed by the hypothesis formulated below.

H0: There is no significant difference in strategic impact with the difference in system testing efficiency.

Table 6.125

Differences: System Testing and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	50	86.06		
Average Efficiency	67	90.31	13.326	0.001*
Poor Efficiency	43	58.74		
Total	160			

Note: * The mean difference is significant at 0.05 level.

The above test in the Table 6.125 was done to prove the significant difference in the strategic impact of ERP due to the difference in the efficiency in system testing and the result is indicating a significant difference as χ^2 =13.326, P=0.001 (p<0.05).

hence it is true to reject the null hypothesis. As the Kruskal Wallis test result is indicating a significant difference, the study needs to conduct a pairwise comparison, which is provided in the below Table.

Table 6.126

Pairwise Comparisons: System Testing and Strategic Impact

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	31.569	9.013	3.503	.000
3.000-1.000	27.316	9.593	2.848	.004
2.000-1.000	-4.253	8.620	-.493	.632

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

The Table 6.126 is revealing a significant difference in the strategic impact of ERP between the organisations with the high efficiency in system testing and poor system testing efficiency and also between the organisations with poor system testing efficiency and average efficiency as the $p<.05$ in both pairs. The mean rank generated from the Kruskal Wallis test reveals that the strategic impact of ERP is very poor in the organisation with poor system testing efficiency while comparing to the mean rank of organisation with higher and average efficiency but even there is association in the pair with average and poor system testing efficiency, it is not statistically significant as $p>0.05$.

C. System Upgradation and Strategic Impact

The following hypothesis is formulated and tested to identify the significant difference in strategic impact of ERP as a result of the differences in the efficiency in system up gradation.

H0: There is no significant difference in strategic impact with the difference in system upgradation efficiency.

Table 6.127

Differences: System Upgradation and Strategic Impact (Kruskal Wallis Statistic)

	N	Mean Rank	Chi square	P Value
High Efficiency	44	86.41		
Average Efficiency	76	92.71	20.746	0.000*
Poor Efficiency	40	52.03		
Total	160			

The test in the Table 6.127 was done to prove whether the differences in the efficiency in System Up gradation made any differences in the strategic impact of ERP and it was found that there is significant difference as χ^2=20.746, P=0.000 ($p<0.05$). hence it is true to reject the null hypothesis. As the test result is showing a significant difference in the strategic impact of ERP, the study needs to compare the different pairs of efficiency to identify its significant difference. The below Table 6.128 reveals the test result.

Table 6.128

Pairwise Comparisons: System Upgradation and Strategic Impact

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	P Value
3.000-2.000	40.041	9.010	4.444	.000
3.000-1.000	34.384	10.077	3.412	.001
2.000-1.000	-5.657	8.737	-.647	.517

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

Table 6.128 is revealing a significant difference in strategic impact of ERP due to the difference in the efficiency level of system up gradation. The study found that there is significant difference in the strategic impact of ERP in the organisation with high efficiency in system upgradation and average efficiency in system upgradation while comparing to the organisations with poor system upgradation efficiency as $p<0.05$ but even there is difference in the pairs with average and higher efficiency, it is not statistically significant as $p>0.05$. The mean rank identified by the

Kruskal Wallis test reveals that the strategic impact of ERP is very poor in the organisation with poor efficiency in system up gradation while compared to the mean rank of organisation with higher and average system upgradation efficiency.

6.9 Impact: CSFs on Organisational Capability (PLS SEM)

The following hypotheses are formulated and tested to find the impact of CSFs on the organisational capability using PLS SEM. The model's effect size (f^2), predictive relevance (Q^2) and the coefficient of determination (R^2) were used to identify the effectiveness and the results are given in the following Table 6.129.

Hypotheses

H0: There is no significant impact of vendor efficiency on organisational capability.

H0: There is no significant impact of consultant efficiency on organisational capability.

H0: There is no significant impact of organisational readiness efficiency on organisational capability.

H0: There is no significant impact of information system readiness efficiency on organisational capability.

H0: There is no significant impact of functional scope on organisational capability.

H0: There is no significant impact of physical scope on organisational capability.

H0: There is no significant impact of consultancy services on organisational capability.

H0: There is no significant impact of customisation level on organisational capability.

H0: There is no significant impact of ERP package vendor on organisational capability.

H0: There is no significant impact of implementation approaches on organisational capability.

Table 6.129

Impact: CSFs on Organisational Capability (PLS SEM)

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
VDE -> OGCB	-0.022	0.031	0.728	0.467	Failed to reject H0	0.005	0.350	0.906
CTE -> OGCB	0.125	0.102	10.994	0.000*	Failed to accept H0	1.542		
OGR -> OGCB	0.19	0.031	6.181	0.000*	Failed to accept H0	0.305		
ISR -> OGCB	-0.134	0.078	1.72	0.086	Failed to reject H0	0.024		
PHS -> OGCB	0.109	0.077	1.411	0.159	Failed to reject H0	0.121		
FNS -> OGCB	0.038	0.096	0.403	0.687	Failed to reject H0	0.004		
CNTS -> OGCB	-0.032	0.033	0.968	0.333	Failed to reject H0	0.008		
CTL -> OGCB	-0.309	0.111	2.779	0.006*	Failed to accept H0	0.118		
EPV -> OGCB	-0.055	0.094	0.587	0.558	Failed to reject H0	0.01		
IMPA -> OGCB	0.097	0.08	1.208	0.227	Failed to reject H0	0.012		

Note: *significant at 5% significance level

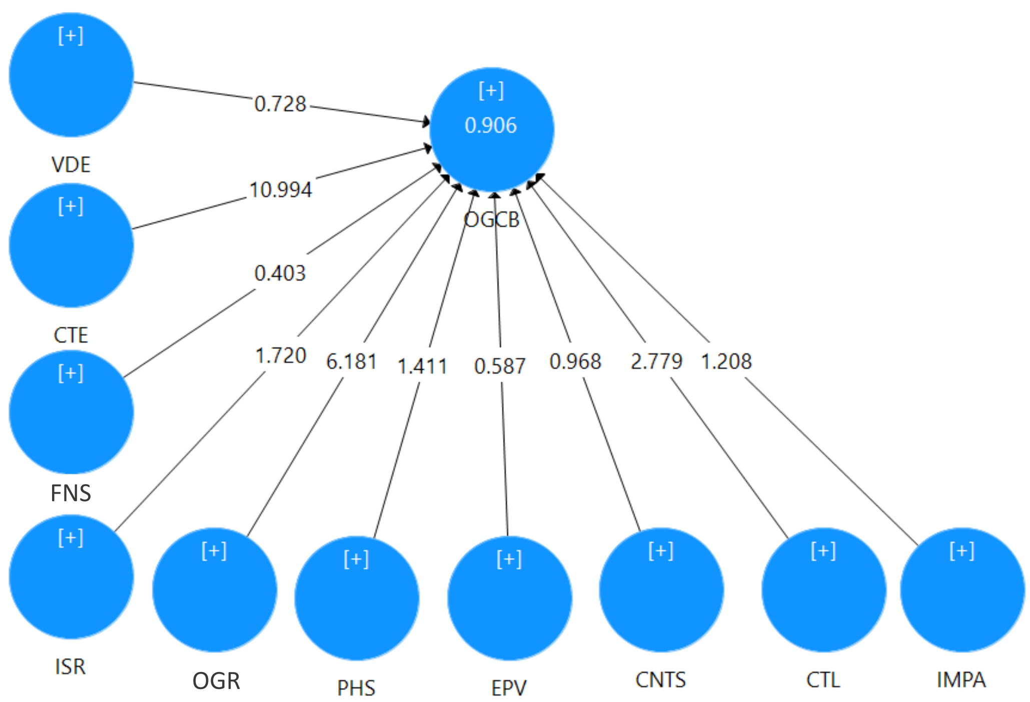
The study tested the null hypothesis to analyse whether vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches made any significant impact on organisational capability. The result revealed that the consultant evaluation, organisational readiness and customisation level have a positive influence on the organisational capability as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on organisational capability (β = 0.625, t = 6.181, p < 0.05), (β = 0.190, t = 6.181, p < 0.05) and (β = 0.309, t = 2.779, p < 0.05) respectively. Hence, H1 was supported. By comparing the three factors together, the consultant evaluation influences the organisational capability mostly (β = 0.625)

The result also revealed that vendor evaluation, functional scope, information system readiness, physical scope, consultancy services, ERP package vendor and implementation approaches have no significant impact on organisational capability as p >0.05. Hence, the study failed to reject null hypothesis.

The result shows that 90.6% variance in organisational capability can be accounted vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches together as the R^2 is 0.906

Figure 6.7

Impact: CSFs on Organisational Capability (PLS SEM)



The path value in the above figure 6.7 is showing a significant impact of the independent variable on the dependent variable, but it is very significant to measure the effect of each exogenous variable on the endogenous variable because in a structural model a variable can affect or can influenced by any number of variables. So, it is essential to determine the effectiveness in the R^2. Here, the consultant evaluation has large effects, functional scope has moderate effect and the customisation level, information system readiness and physical scope have weak effect and consultancy services, ERP package vendor, implementation approaches, organisational readiness and vendor evaluation have no effect on the organisational capability The small effect: f-square is ≥ 0.02, medium effect: f-square ≥ 0.15 and large effect: f square is ≥ 0.35 (Cohen, 1988))

The value used in the model are reconstructed perfectly and the model has a predictive relevance as the $Q^2 > 0$

6.10 Impact: CSFs on the Components of Organisational Capability (PLS SEM)

The study analysed the impact of CSFs on organisational capability. organisational capability is the overall capability of the organisation. The study identified that the endogenous variables, inbound logistics, outbound logistics, operational excellence, decision making, and strategic impact together contribute in making the organisation capable. In the previous part, the study critically analysed the association and impact of the exogenous variable on the overall organisational capability. This section of the analysis is trying to identify the impact on each component of organisational capability separately. The following hypotheses are formulated to test the significant impact on inbound logistics Capability. The study used SEM (Shown in figure 6.8) to identify, whether there is any impact of CSFs on the components organisational capability and the model's effect size (f^2), predictive relevance (Q^2) and the coefficient of determination (R^2) to identify the effectiveness. The hypothesis are formulated below in Table 6.130 and the test results are given in the Table 6.131.

Table 6.130

Hypotheses: Impact: CSFs on Dependent Variables

H0:	Independent Variable	Dependent Variable
There is no Significant impact of	Vendor Efficiency on	Organisational Capability
	Consultant Efficiency on	
	Organisational Readiness Efficiency on	Inbound Logistics
	Information System Readiness Efficiency on	Outbound Logistics
	Functional Scope on	Operational Excellence
	Physical Scope on	
	Consultancy Services on	Decision Making
	Customisation Level on	
	ERP Package Vendor on	Strategic Impact
	Implementation Approaches on	

Table 6.131

Impact: CSFs on the components of Organisational Capability (PLS SEM)

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
VDE -> **INLO**	0.001	0.033	0.031	0.975	Failed to reject H0	0	0.621	0.941
CTE -> INLO	0.289	0.061	4.721	**0.000***	Rejected H0	0.345		
OGR -> **INLO**	0.572	0.041	14.102	**0.000***	Rejected H0	2.22		
ISR -> **INLO**	0.717	0.097	7.391	**0.000***	Rejected H0	1.123		
PHS -> **INLO**	-0.058	0.049	1.192	0.234	Failed to reject H0	0.006		
FNS -> **INLO**	0.03	0.058	0.516	0.606	Failed to reject H0	0.001		
CNTS -> **INLO**	0.01	0.021	0.462	0.644	Failed to reject H0	0.001		

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
CTL -> **INLO**	0.104	0.044	2.345	**0.019***	Rejected H0	0.091		
EPV -> **INLO**	0.036	0.045	0.81	0.418	Failed to reject H0	0.005		
IMPA -> **INLO**	-0.048	0.079	0.602	0.547	Failed to reject H0	0.002		
VDE -> OTLO	-0.023	0.033	0.686	0.493	Failed to reject H0	0.005	0.546	0.952
CTE -> OTLO	-0.007	0.039	0.174	0.862	Failed to reject H0	0		
OGR -> OTLO	-0.009	0.031	0.298	0.766	Failed to reject H0	0.001		
ISR -> OTLO	0	0.054	0.008	0.994	Failed to reject H0	0		
PHS -> OTLO	0.159	0.056	2.825	**0.005***	Failed to reject H0	0.055		
FNS -> OTLO	0.955	0.043	22.033	**0.000***	Rejected H0	0.059		
CNTS -> OTLO	0.001	0.023	0.053	0.957	Failed to reject H0	0		
CTL -> OTLO	0.017	0.025	0.695	0.487	Failed to reject H0	0.003		
EPV -> OTLO	0.11	0.039	2.811	**0.005***	Rejected H0	0.059		
IMPA -> OTLO	-0.033	0.069	0.469	0.640	Failed to reject H0	1.735		
VDE -> OPXL	0.016	0.061	0.261	0.794	Failed to reject H0	0.001	0.539	0.856
CTE -> OPXL	0.12	0.093	1.282	0.200	Failed to reject H0	0.024		
OGR -> OPXL	0.665	0.069	9.644	**0.000***	Rejected H0	1.231		
ISR -> OPXL	-0.016	0.131	0.12	0.904	Failed to reject H0	0		
PHS -> OPXL	0.01	0.092	0.113	0.910	Failed to reject H0	1.231		
FNS -> OPXL	0.24	0.092	2.597	**0.010***	Rejected H0	0.037		

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
CNTS -> OPXL	0.063	0.038	1.65	0.100	Failed to reject H0	0.018		
CTL -> OPXL	0.273	0.065	4.226	**0.000***	Rejected H0	0.256		
EPV -> OPXL	0	0.071	0.005	0.996	Failed to reject H0	0		
IMPA -> OPXL	-0.278	0.133	2.086	**0.037***	Rejected H0	0.023		
VDE -> DNMK	-0.005	0.062	0.074	0.941	Failed to reject H0	0.001	0.535	0.831
CTE -> DNMK	0.085	0.093	0.918	0.359	Failed to reject H0	0.011		
OGR -> DNMK	0.579	0.088	6.562	**0.000***	Rejected H0	0.799		
ISR -> DNMK	0.108	0.147	0.735	0.463	Failed to reject H0	0.009		
PHS -> DNMK	0.095	0.106	0.898	0.370	Failed to reject H0	0.006		
FNS -> DNMK	0.201	0.103	1.955	0.051	Failed to reject H0	0.022		
CNTS -> DNMK	0.111	0.042	2.623	**0.009***	Failed to reject H0	0.047		
CTL -> DNMK	0.225	0.062	3.61	**0.000***	Rejected H0	0.149		
EPV -> DNMK	-0.085	0.081	1.056	0.291	Failed to reject H0	0.01		
IMPA -> DNMK	-0.258	0.152	1.697	0.090	Failed to reject H0	0.017		
VDE -> STIM	0.486	0.045	10.785	**0.000***	Rejected H0	0	0.542	0.884
CTE -> STIM	0.421	0.089	4.724	**0.000***	Rejected H0	0.011		
OGR -> STIM	-0.107	0.06	1.768	0.078	Failed to reject H0	0.039		
ISR -> STIM	0.132	0.113	1.17	0.242	Failed to reject H0	0.019		
PHS -> STIM	-0.048	0.064	0.751	0.453	Failed to reject H0	0.002		

Hypothesis/ Relationship	Std beta	(STDEV)	T Statistics	P Values	Decisions	f^2	Q^2	R^2
FNS -> STIM	0.188	0.081	2.326	**0.020***	Rejected H0	0.028		
CNTS -> STIM	0.006	0.028	0.203	0.839	Failed to reject H0	0		
CTL -> STIM	0.125	0.049	2.537	**0.011***	Rejected H0	0.067		
EPV -> STIM	-0.062	0.051	1.223	0.222	Failed to reject H0	0.008		
IMPA -> STIM	-0.083	0.109	0.761	0.447	Failed to reject H0	0.003		

Note: *significant at 5% significance level

The study tested the null hypotheses evaluates whether vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches has a significant impact on the components of organisational capability (inbound logistics, outbound logistics, operational excellence, decision making and strategic impact).

While considering inbound logistics the result reveals that consultant evaluation, organisational readiness, information system readiness and customisation level are showing a positive significant impact on inbound logistics as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on organisational capability ($\beta = 0.289$, $t = 4.721$, $p < 0.05$), ($\beta = 0.572$, $t = 14.102$, $p < 0.05$), ($\beta = 0.717$, $t = 7.391$, $p < 0.05$), ($\beta = 0.104$, $t = 2.345$, $p < 0.05$), Hence the study rejected the null hypotheses. The result also indicates that the vendor evaluation, functional scope, physical scope, consultancy services, ERP package vendor and implementation approaches did not make any significant impact as $p>0.05$. Hence, the study failed to reject null hypotheses. By comparing the four factors together, the information system readiness influences the inbound logistics mostly while comparing to the other factors ($\beta = 0.717$).

The result shows that 94.1% variance in inbound logistics can be accounted to vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches together as the R^2 is 0.941.

While considering outbound logistics the result reveals that physical scope, functional scope and ERP package vendor has showing a positive significant impact on outbound logistics as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on outbound logistics ($\beta = 0.159$, $t = 2.825$, $p < 0.05$), ($\beta = 0.955$, $t = 22.033$, $p < 0.05$), ($\beta = 0.110$, $t = 2.811$, $p < 0.05$), hence the study rejected the H0. The remaining independent variable, vendor evaluation, consultant evaluation, organisational readiness, information system readiness, consultancy services, customisation level, and implementation approaches doesn't make any significant impact on outbound logistics as $p>0.05$, hence, the study failed to reject null hypotheses. While comparing the impacted factors together, the functional scope influences the outbound logistics mostly while comparing to the other factors ($\beta = 0.955$).

The result shows that 95.2% variance in outbound logistics can be accounted to vendor evaluation, consultant evaluation, organisational readiness, and IST together as the R^2 is 0.952.

While focusing on operational excellence, the result reveals that organisational readiness functional scope, customisation level and implementation approaches have showing a positive significant impact on operational excellence as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on operational excellence ($\beta = 0.665$, $t = 9.644$, $p < 0.05$), ($\beta = .240$, $t = 2.597$, $p < 0.05$), ($\beta = 0.273$, $t = 4.226$, $p < 0.05$) and ($\beta = 0.278$, $t = 2.086$, $p < 0.05$) respectively, hence the study rejected the H0. The remaining independent variable, vendor evaluation, consultant evaluation, information system readiness, physical scope, consultancy services and ERP package vendor doesn't make any significant impact on outbound logistics as $p>0.05$, hence, the study failed to reject H0. By comparing the four factors together, the organisational readiness influences the operational excellence mostly as $\beta = 0.659$, greater than other variables

The result shows that 85.6% variance in operational excellence can be accounted to vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches together as the R^2 is 0.856.

Regarding the impact on decision making, the result conveys that organisational readiness, consultancy services and customisation level are showing a positive significant impact on decision making as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on decision making ($\beta = 0.579$, $t = 6.562$, $p < 0.05$), ($\beta = 0.111$, $t = 2.623$, $p < 0.05$) and ($\beta = 0.225$, $t = 3.61$, $p < 0.05$) respectively, hence the study rejected the H0. The vendor evaluation, consultant evaluation, information system readiness, functional scope, physical scope, ERP package vendor and implementation approaches indicates an insignificant impact on decision making as $p>0.05$ hence failed to reject null hypotheses. By comparing the factors together, the organisational readiness influences the decision making mostly while comparing to the other factors ($\beta = 0.579$).

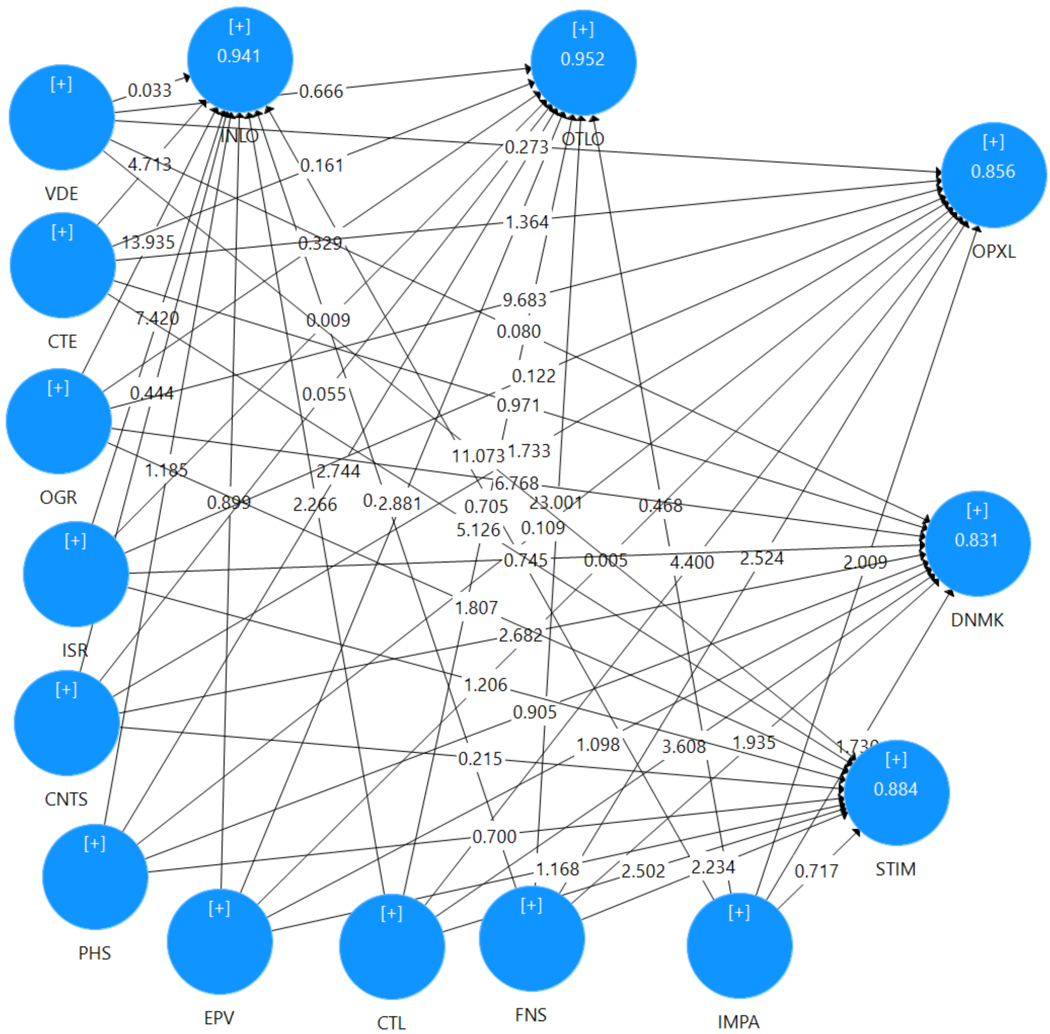
The result shows that 83.1% variance in decision making can be accounted to vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches together as the R^2 is 0.831.

While focusing on strategic impact, the result reveals that vendor evaluation, consultant evaluation, functional scope and customisation level are showing a positive significant impact on strategic impact as the path coefficient or beta value are sufficient and the p value is indicating a significant effect on strategic impact ($\beta = 0.486$, $t = 10.785$, $p < 0.05$), ($\beta = 0.421$, $t = 4.724$, $p < 0.05$), ($\beta = 0.188$, $t = 2.326$, $p < 0.05$) and ($\beta = 0.125$, $t = 2.537$, $p < 0.05$) respectively, hence the study rejected the H0. The vendor evaluation, consultant evaluation, information system readiness, functional scope, physical scope, ERP package vendor and implementation approaches indicate an insignificant impact on decision making as $p>0.05$ hence failed to reject H0. By comparing the factors together, the vendor evaluation influences the strategic impact mostly while comparing it to the other factors (β = 0.486).

The result shows that 88.4% variance in strategic impact can be accounted for by vendor evaluation, consultant evaluation, organisational readiness, information system readiness, functional scope, physical scope, consultancy services, customisation level, ERP package vendor and implementation approaches together as the R^2 is 0.884, which is presented in the below figure 6.8.

Figure 6.8

Impact: CSFs on the Components of Organisational Capability (PLS SEM)



The path value is showing a significant impact of the independent variable on the dependent variable, but it is very significant to measure the effect of each exogenous variable on the endogenous variable because in a structural model a variable can affect or can influenced by any number of variables. So, it is essential to determine the effectiveness in the R^2 through f^2

Here, changes in consultancy services ERP package vendor functional scope implementation approaches vendor evaluation show no effect, changes in consultant evaluation, customisation level indicates a medium effect and information system readiness organisational readiness physical scope shows a large effect on inbound logistics. consultancy services, consultant evaluation, customisation level, implementation approaches, information system readiness, organisational readiness and vendor evaluation shows no effect, ERP package vendor and physical scope make medium effect and functional scope makes larger effect on outbound logistics. consultancy services, ERP package vendor, information system readiness, physical scope, vendor evaluation shows no effect, consultant evaluation, functional scope, implementation approaches imply small effect, customisation level shows medium effect and finally organisational readiness makes larger effects on R^2 of operational excellence. consultant evaluation, ERP package vendor, implementation approaches, information system readiness, physical scope and vendor evaluation shows no effect, consultancy services, customisation level and functional scope implies small effect and finally organisational readiness makes larger effects on R^2 of decision making. consultancy services, ERP package vendor, implementation approaches, information system readiness, physical scope shows no effect, customisation level, functional scope,organisational readiness implies small effect and finally consultant evaluation and vendor evaluation makes larger effects on R^2 of strategic impact. (Cohen, 1988) the small effect: f-square is ≥ 0.02, medium effect: f-square ≥ 0.15 and large effect: f square is ≥ 0.35).

The value used in the model are reconstructed perfectly and the models have a predictive relevance as the $Q^2 > 0$.

6.11 Summary

The chapter analysed the impact of CSFs in the process of ERP implementation on the organisational capability and it's components. Kruskal Wallis Test, Dunn Test, Mann Whitney U Test and PLS SEM were used to find the differences and impact of the variables. The study found that even the entire CSFs made difference in the organisational capability and its components a few of them made a significant difference. The below Table 6.132 listed those CSFs which made a statistically significant difference in the organisational capability, inbound logistics, operational excellence, decision making capability and in strategic impact of ERP. The study did not find any significant difference in outbound logistics with differences the CSFs in ERP implementation. The following Table 6.132, 6.133, 6.134, 6.135 and 6.136 presents the summary of those CSFs, which made a statistically significant difference in the dependent variables.

Table 6.132

CSFs – Significant Difference in Organisational Capability (Summary)

Hypotheses	Results	Decisions	Findings
vendor scalability→ Organisational Capability	Significant Difference	Failed to accept H0	vendor scalability↑ Organisational Capability ↑
consultant scalability→ Organisational Capability	Significant Difference	Failed to accept H0	consultant scalability↑ Organisational Capability ↑
Customisation Level → Organisational Capability	Significant Difference	Failed to accept H0	Minor Customisation (1-10%) - High Organisational Capability Zero Customisation - Poor Organisational Capability
Resource Mobilisation →	Significant Difference	Failed to accept H0	Resource Mobilisation Efficiency ↑

Hypotheses	Results	Decisions	Findings
Organisational Capability			Organisational Capability ↑
BPR → Organisational Capability	Significant Difference	Failed to accept H0	BPR Efficiency ↑ Organisational Capability ↑
System Up gradation→ Organisational Capability	Significant Difference	Failed to accept H0	System Up gradation Efficiency ↑ Organisational Capability ↑

Table 6.133

CSFs – Significant Difference in Inbound Logistics (Summary)

Hypotheses	Results	Decisions	Findings
vendor viability → Inbound Logistics	Significant Difference	Failed to accept H0	vendor viability↑ Inbound Logistics Capability↑
vendor scalability → Inbound Logistics	Significant Difference	Failed to accept H0	vendor scalability↑ Inbound Logistics Capability↑
consultant scalability→Inbound Logistics	Significant Difference	Failed to accept H0	consultant scalability↑ Inbound Logistics Capability↑
Resource Mobilisation → Inbound Logistics	Significant Difference	Failed to accept H0	Resource Mobilisation Efficiency↑ Inbound Logistics Capability↑

Table 6.134

CSFs – Significant Difference in Operational Excellence (Summary)

Hypotheses	Results	Decisions	Findings
vendor scalability → Operational Excellence	Significant Difference	Failed to accept H0	vendor scalability↑ Operational Excellence ↑
consultant scalability→ Operational Excellence	Significant Difference	Failed to accept H0	consultant scalability↑ Operational Excellence ↑
Resource Mobilisation → Operational Excellence	Significant Difference	Failed to accept H0	Resource Mobilisation Efficiency↑ Operational Excellence ↑
BPR→ Operational Excellence	Significant Difference	Failed to accept H0	BPR Efficiency↑ Operational Excellence ↑
Customisation Level → Operational Excellence	Significant Difference	Failed to accept H0	Minor Customisation- Higher Operational Excellence Major Customisation- Lower operational excellence
Data Migration → Operational Excellence	Significant Difference	Failed to accept H0	Data Migration Efficiency↑ Operational Excellence ↑
System Testing → Operational Excellence	Significant Difference	Failed to accept H0	System Testing Efficiency↑ Operational Excellence ↑
System Upgradation → Operational Excellence	Significant Difference	Failed to accept H0	System Upgradation Efficiency↑ Operational Excellence ↑

Table 6.135

CSFs – Significant Difference in Decision Making Capability (Summary)

Hypotheses	Results	Decisions	Findings
Vendor scalability →Decision Making Capability	Significant Difference	Failed to accept H0	Vendor Scalability↑ Decision Making Capability ↑
Consultant Scalability → Decision Making Capability	Significant Difference	Failed to accept H0	consultant scalability↑ Decision Making Capability ↑
Resource Mobilisation → Decision Making Capability	Significant Difference	Failed to accept H0	Resource Mobilisation efficiency↑ Decision Making Capability ↑

Table 6.136

CSFs – Significant Difference in Strategic Impact (Summary)

Hypotheses	Results	Decisions	Findings
Resource mobilisation→ Strategic Impact	Significant Difference	Failed to accept H0	Resource Mobilisation efficiency↑ Strategic Impact ↑
BPR→ Strategic Impact	Significant Difference	Failed to accept H0	Average BPR Efficiency- Higher Strategic Impact Low BPR Efficiency- Low Strategic Impact
End-User Training → Strategic Impact	Significant Difference	Failed to accept H0	High End-User Training Efficiency- Higher Strategic Impact Average End-User Training - Lower Strategic Impact

Hypotheses	Results	Decisions	Findings
System Testing → Strategic Impact	Significant Difference	Failed to accept H0	Average System Testing Efficiency- Higher Strategic Impact Low System Testing Efficiency- Lower Strategic Impact
System Upgradation → Strategic Impact	Significant Difference	Failed to accept H0	Average System Upgradation Efficiency- Higher Strategic Impact Lower System Upgradation Efficiency- Lower Strategic Impact

The analysis results indicate that the CSFs in the process of EPR implementation made a major variation in the organisational capability and its components except outbound logistics.

References

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Chapter Seven

ERP IMPLEMENTATION IMPACT: FINANCIAL PERFORMANCE

7.1 Introduction

ERP has been widely used in the manufacturing sector, finance sector and service sector (Ahlawat, 2011). The study selected manufacturing sector to measure the impact of ERP implementation as the manufacturing units can reveal the outcome more precisely compared to other industrial sectors. To know the impact, first the study identified different processes of ERP implementation and then it identified the CSFs spotted in the implementation process. After analysing the impact of the selected CSFs on the organisational capability, the study checked, whether these factors made any changes in the financial performance of the selected manufacturing units.

This chapter investigates the outcome of ERP in terms of financial performance of the organisation. The objective of this chapter is to check the impact of the selected CSFs in the process of ERP implementation on the financial performance of the organisation.

This chapter is divided into two sections:

First: Interpreting the result of regression analysis on the impact of CSFs on Financial performance based on the 10 years data taken for the study (comparison of 5years prior to and 5 years post ERP implementation year) and 20 years data taken for the study (comparison 10 years prior to and 10 years post ERP implementation year)

Second: Comparison of the financial performance from the test result obtained by analysing the financial performance of the organisation after five years of ERP implementation and the test result obtained by analysing the financial performance after ten years of ERP implementation. The comparison is done to check, whether there is any difference in the financial performance of the organisation from the immediate 5 years of ERP implementation to the post 10 years of ERP implementation.

As the study required financial data about 10 years prior to and 10 years post implementation, the study eliminated 9 samples due to unavailability of data in the prowess data base. So, the study used only 151 samples to assess the changes in financial performance after the ERP implementation.

7.2 Assumptions

The study is required to check whether the data set satisfies the regression assumption. After verifying mean, median, standard deviations and minimum and maximum values for the corresponding variables, it was found out that none of the variables revealed any outliers. The significant correlation coefficients among the independent variables are within the threshold 0.80 (Gujarati & Porter, 2009) & (Dougherty, 2016) as the maximum value of the correlation coefficient is 0.71. The study identified that the variables used for analysing the financial performance of the enterprises are free from multicollinearity issues, as the VIF value is less than 4 (Hair et al., 2010). Durbin-Watson (d) test and Breusch-Godfrey (BG) test indicate that there is no autocorrelation in error terms as the p value is greater than 0.05. The Breusch-Pagan test indicate that there is no heteroscedasticity issue i.e., there is homoscedasticity as the p value is greater than 0.05. The study identified that none of the assumptions of multiple regression analysis has been violated.

As the assumptions of the multiple regression analysis was satisfied, the study is required to identify the impact of the selected CSFs on the financial performance of the selected ERP implemented enterprises in the post implementation period. The study used multiple regression in Excel to analyse the impact on financial performance.

7.3 Impact: CSFs on Financial Performance

Here the study selected Return On Assets (ROA), Return on Sales (ROS),Selling General and Administrative Expenses (SG&A), Cost of Goods Sold (CGS), Asset Turnover Ratio (ATR), Debtors Turnover Ratio (DTR), Inventory Turnover Ratio (ITR) and Fixed Asset Turnover Ratio (FAT) as dependent variable (Response Variable) to analyse the effect of the independent variable (Predictor

Variable) Functional Scope (FNS), Physical Scope (PHS), ERP Vendor (EPV), Customisation Level (CTL), adoption and non-adoption of Consultancy Services (CNTS) and the difference in the Implementation Approaches (IMPA). The study used Market Capitalisation (Mkt Cap), No. of Employees (Number of Employees), Total Assets and Debt Equity Ratio (DER) as control variables.

For the purpose of testing the hypothesis to examine the impact of CSFs on the financial performance of the selected organisations, the following statistical equation or multiple regression model was developed.

$$ROA_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$ROS_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$SG\&A_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$CGS_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$ATR_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$DTR_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$ITR_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\, Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

$$FAT_{it} = \beta_0 + \beta_1\, FNS_{it} + \beta_2\, PHS_{it} + \beta_3\, EPV_{it+} + \beta_3\, CTL_{it} + \beta_4\, CNTS_{it} + \beta_5\, IMPA_{it} + \beta_6\, Mkt\ Cap_{it} + \beta_7\, No.of\ Employees_{it} + \beta_8\, DER_{it} + \beta_9 D_{it} + \varepsilon_{it}$$

Where,

ROA = Return on Asset

ROS = Return on Sale

SG&A = Selling General and Administrative Expenses

CGS = Cost of Goods Sold

ATR = Asset Turnover Ratio

DTR = Debtors Turnover Ratio

ITR = Inventory Turnover Ratio

FAT = Fixed Asset Turnover Ratio

FNS = Functional Scope

PHS = Physical Scope

EPV = ERP Package Vendor

CTL = Customisation Level

CNTS = Consultancy Service

IMPA = Implementation Approaches

Mkt Cap = Market Capitalisation

No. of Employees =Number of Employees

DER = Debt Equity Ratio

D = Dummy Variable

ε = Error Term

In this context, 'D' refers to the dummy variable used to represent the time or period of the ERP implementation in the organisations. The code zero (0) gives to the pre-ERP implementation period and one (1) to the post ERP implementation period. Thus, the study can compare the pre and post ERP implementation period.

7.3.1 Impact: CSFs on Return on Assets (ROA)

It is required to test whether there is any relationship between the CSFs selected for the study and the selected indicators of the financial performance of the organisation. In this section, the study formulated the following hypothesis to test the significant relationship of CSFs on the ROA of the organisation.

The following hypotheses are used to test the impact of CSFs on the ROA in the post 5 years.

H0: There is no significant impact of functional scope on ROA.

H0: There is no significant impact of physical scope on ROA.

H0: There is no significant impact of ERP package vendor on ROA.

H0: There is no significant impact of consultancy services on ROA.

H0: There is no significant impact of customisation level on ROA.

H0: There is no significant impact of implementation approaches on ROA.

The following hypotheses are used to test the impact of CSFs on the ROA in the post 10 years.

H0: There is no significant impact of functional scope on ROA.

H0: There is no significant impact of physical scope on ROA.

H0: There is no significant impact of ERP package vendor on ROA.

H0: There is no significant impact of consultancy services on ROA.

H0: There is no significant impact of customisation level on ROA.

H0: There is no significant impact of implementation approaches on ROA.

Table 7.1

Impact: CSFs on Return on Assets (ROA)

	Post 5 years			Post 10 years		
Variable	**Coefficient**	**t-Statistic**	**Prob.**	**Coefficient**	**t-Statistic**	**Prob.**
Constant	0.047329	2.477301	0.0133	0.105555	4.279860	0.0000
FNS	-0.003347	-1.230164	0.2188	0.000996	0.359039	0.7196
PHS	0.001176	0.453693	0.6501	-0.000682	-0.277175	0.7817
EPV	-0.000511	-0.122381	0.9026	-0.002258	-0.553118	0.5802
CNTS	0.124712	3.635022	0.0003*	0.003562	1.322498	0.1861
CTL	-0.006217	-2.283692	0.0225*	-0.004648	-0.932582	0.3511
IMPA	-0.001375	1.380477	0.3336	-0.003357	0.965917	0.7042
Market Cap	0.013250	10.19759	0.0000	0.018359	12.57311	0.0000
Debt Equity Ratio	-0.015314	-6.207459	0.0000	-0.154324	-5.204459	0.0000
No. of Employees	-0.011286	-5.919268	0.0000	-0.004862	-2.258219	0.0240
R^2	0.522811			0.493613		
Adjusted R^2	0.516842			0.489656		
S.E. of regression	0.071857			0.060450		
F-Statistic	16.11189			15.17058		
Prob(F-statistic)	0.000000			0.000000		

Note: *significant at 5% significance level

The p-value that corresponds to t = -2.283692 (post 5 years) and t = -0.932582 (post 10 years) for the variable Customisation Level is 0.0225 and 0.3511 respectively. The p-value that corresponds to t = 3.635022 (post 5 years) and t = 1.322498 (post 10 years) for the variable Consultancy Services is 0.0003 and 0.1861 respectively. Since the $p<.05$ in the post 5 years for both Customisation Level and Consultancy Services, the study failed to accept null hypotheses of the concerned periods. But the study failed to reject the null hypotheses, regarding the impact of Customisation Level and the Consultancy Services in the post 10 years of ERP implementation and it also failed to reject the null hypotheses to test the impact of Functional Scope, Physical Scope, ERP Package Vendor and Implementation

Approaches on the financial performance in both post 5 years and post 10 years as p > 0.05.

Here Adjusted R^2 reveals that 51.68% variation in the ROA in the post 5 years is dependent on the identified CSFs in the process of ERP implementation but it decreased to 48.96 % in the post 10 years. However, the data of both periods fit the regression model, and both are statistically significant

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the ROA where F (P) <0.05 in both periods. So, the study concludes that the predictor variables altogether made an impact on the ROA of the selected organisations.

7.3.2 Impact: CSFs on Return on Sales (ROS)

The significant relationship between the selected CSFs and ROS can measure by regressing the below formulated hypotheses.

The following hypotheses are used to test the impact of CSFs on the ROS in the post 5 years.

H0: There is no significant impact of functional scope on ROS.

H0: There is no significant impact of physical Scope on ROS

H0: There is no significant impact of ERP package vendor on ROS

H0: There is no significant impact of consultancy Services on ROS

H0: There is no significant impact of customisation Level on ROS

H0: There is no significant impact of Implementation Approaches on ROS

The following hypotheses are used to test the impact of CSFs on the ROS in the post 10 years.

H0: There is no significant impact of functional scope on ROS

H0: There is no significant impact of physical Scope on ROS

H0: There is no significant impact of ERP package vendor on ROS

H0: There is no significant impact of consultancy services on ROS

H0: There is no significant impact of customisation level on ROS

H0: There is no significant impact of implementation approaches on ROS

Table 7.2

Impact: CSFs on Return on Assets (ROS)

Variable	Post 5 years			Post 10 years		
	Coefficient	**t-Statistic**	**Prob.**	**Coefficient**	**t-Statistic**	**Prob.**
Constant	0.008832	0.034030	0.9729	0.010876	0.056321	0.9551
FNS	-0.009150	-0.795392	0.4265	-0.011669	-1.339150	0.1807
PHS	-0.001593	-0.186101	0.8524	-0.000560	-0.064479	0.9486
EPV	0.018032	0.756678	0.4493	0.019075	0.847639	0.3967
CNTS	0.129096	2.740216	0.0414*	0.109718	2.060350	0.0479*
*CTL	-0.129718	-2.031350	0.0423*	-0.026516	-1.728854	0.0840
IMPA	0.018745	0.903537	0.3663	0.017542	0.790028	0.4296
Market Cap	0.005130	0.676275	0.4989	0.002261	0.479300	0.6318
Debt Equity Ratio	-0.006020	-0.423518	0.6720	-0.106020	-0.426519	0.7205
Number of Employees	0.010829	0.274322	0.7839	0.007098	0.154228	0.8774
R-squared	0.230101			0.217194		
Adjusted R-squared	0.2152600			0.204459		
S.E. of regression	0.917199			0.927564		
F-statistic	11.746055			9.914980		
Prob(F-statistic)	0.000104			0.000260		

Note: *significant at 5% significance level

The p-value that corresponds to $t = 2.740216$ (post 5 years) and t = 2.060350 (post 10 years) for the variable Consultancy Services is 0.0414 and 0.0479 respectively. Since the $p<.05$ in the post 5 years and 10 years of Consultancy Services, the study failed to accept the null hypotheses of both periods and the result indicating a positive relationship between Consultancy Services and ROS

The p-value that corresponds to *t* = -2.031350 (post 5 years) and t = -1.728854 (post 10 years) for the variable Customisation Level is 0.0423and 0.0840 respectively. Since the $p<.05$ in the post 5 years of Customisation Level, the study failed to accept the null hypothesis of the concerned period only and failed to reject the H0 of the post 10 years. The study identified a negative relationship between Customisation Level and ROS.

The study also failed to reject the null hypotheses to test the impact of Functional Scope, Physical Scope, ERP Package Vendor and Implementation Approaches on the financial performance in both post 5 years and post 10 years as $p > 0.05$.

Here Adjusted R^2 reveals that 21.53% variance in the ROS in the post 5 years is dependent on the identified CSFs in the process of ERP implementation but it decreased to 20.45 % in the post 10 years. However, the data of both periods fit the regression model and are statistically significant.

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the ROS where F(P) <0.05, in both periods, even though there was no significant impact of any CSFs in the post 10 years. So, the study concludes that the all the predictor variables are jointly significant.

7.3.3 Impact: CSFs on Selling, General and Administrative Expenses (SG&A)

This section of the chapter discusses the impact of functional scope, physical scope, ERP vendor, adoption and non-adoption of consultancy services and the difference in the implementation approaches adopted by different organisations on SG&A of an organisation, thereby the study can measure the overall performance of the organisation.

The following hypotheses are used to test the impact of CSFs on the SG&A in the post 5 years.

H0: There is no significant impact of functional scope on SG&A

H0: There is no significant impact of Physical Scope on SG&A

H0: There is no significant impact of ERP Package Vendor on SG&A

H0: There is no significant impact of Consultancy Services on SG&A

H0: There is no significant impact of Customisation Level on SG&A

H0: There is no significant impact of Implementation Approaches on SG&A

The following hypotheses are used to test the impact of CSFs on the SG&A in the post 10 years.

H0: There is no significant impact of Functional Scope on SG&A

H0: There is no significant impact of Physical Scope on SG&A

H0: There is no significant impact of ERP Package Vendor on SG&A

H0: There is no significant impact of Consultancy Services on SG&A

H0: There is no significant impact of Customisation Level on SG&A

H0: There is no significant impact of Implementation Approaches on SG&A

Table 7.3

Impact: CSFs on Selling, General and Administrative Expenses (SG&A)

Variable	Post 5 years			Post 10 years		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
Constant	2.048678	10.45189	0.0000	-0.448854	5.044375	0.0000
FNS	-0.576113	-8.806858	0.0000*	-0.02424	-2.577401	0.0048*
PHS	-0.137838	-3.382292	0.0007*	-0.035190	-1.421717	0.1552
EPV	-0.005342	-1.035677	0.3005	0.025596	0.384964	0.7003
CNTS	-0.141979	-3.851685	0.0001*	-0.007552	-0.341461	0.7328
CTL	-0.153219	-5.055016	0.0000*	-0.024177	-0.566999	0.5708
IMPA	0.022600	0.392327	0.6949	0.028861	1.019119	0.3083
Market Cap	0.347477	21.75527	0.0000	0.025596	7.185462	0.0000
Debt Equity Ratio	0.053860	3.571558	0.0004	0.053860	3.571558	0.0004
Number of Employees	0.453982	19.06123	0.0000	0.093370	5.351563	0.0000
R-squared	0.674536			0.455678		
Adjusted R-squared	0.652255			0.435879		
S.E. of regression	0.612156			0.985758		
F-statistic	372.9674			116.4766		
Prob(F-statistic)	0.000000			0.000000		

Note: *significant at 5% significance level

The p-value that corresponds to *t* = -8.806858 (post 5 years) and t = -2.577401 (post 10 years) for the variable Functional Scope is 0.0000 and 0.0048 respectively. Since the $p<.05$ in the post 5 years and 10 years of Functional Scope, the study failed to accept the null hypotheses of both periods and found a negative relationship between Functional Scope and SG&A

The p-value that corresponds to *t* =-3.382292 (post 5 years) and t = -1.421717 (post 10 years) for the variable Physical Scope is 0.0007 and 0.1552 respectively. The p-value that corresponds to *t* = -3.851685 (post 5 years) and t = -0.341461 (post 10 years) for the variable Consultancy Services is 0.0001 and 0.7328 respectively. The p-value that corresponds to *t* = -5.055016 (post 5 years) and t = -0.566999 (post 10 years) for the variable Customisation Level is 0.0000 and 0.5708 respectively Since the $p<.05$ in the post 5 years of Functional Scope, Physical Scope, Consultancy Services and Customisation Level on SGAE, the study failed to accept the null hypotheses and found a negative relationship.

Here Adjusted R^2 reveals that 65.22% variance in the SG&A in the post 5 years is dependent on the identified CSFs in the process of ERP implementation but it decreased to 43.59 % in the post 10 years. However, the data of both periods fit the regression model, and both are statistically significant.

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the SG&A where $F(P) <0.05$ in both post 5 and 10 years. So, the study concludes that the all the predictor variables are jointly significant.

7.3.4 Impact: CSFs on Cost of Goods Sold (CGS)

The study formulated and tested the below hypotheses to test the impact of Functional Scope, Physical Scope, ERP Package Vendor, Consultancy Services, Customisation Level and Implementation Approaches on the Cost of Goods Sold in the post 5 years and post 10 years of ERP implementation.

The following hypotheses are used to test the impact of CSFs on CGS in the post 5 years

H0: There is no significant impact of functional scope on CGS

H0: There is no significant impact of physical Scope on CGS

H0: There is no significant impact of ERP package vendor on CGS

H0: There is no significant impact of Consultancy Services on CGS

H0: There is no significant impact of Customisation Level on CGS

H0: There is no significant impact of Implementation Approaches on CGS

The following hypotheses are used to test the impact of CSFs on the CGS in the post 10 years.

H0: There is no significant impact of Functional Scope on CGS

H0: There is no significant impact of Physical Scope on CGS

H0: There is no significant impact of ERP Package Vendor on CGS

H0: There is no significant impact of Consultancy Services on CGS

H0: There is no significant impact of Customisation Level on CGS

H0: There is no significant impact of Implementation Approaches on CGS

Table 7.4

Impact: CSFs on Cost of Goods Sold (CGS)

Variable	Post 5 years			Post 10 years		
	Coefficient	**t-Statistic**	**Prob.**	**Coefficient**	**t-Statistic**	**Prob.**
Constant	1.658287	8.208659	0.0000	0.019826	0.096281	0.0000
FNS	-0.296633	-9.109111	0.0000*	-0.050892	-3.312818	0.0196*
PHS	-0.173178	-4.094570	0.0000*	-0.069647	-2.601968	0.9233
EPV	0.043813	0.644106	0.5196	-0.143752	0.713403	0.6208
CNTS	-0.152092	-3.895080	0.0001*	-0.016722	-0.687391	0.8193
CTL	-0.163654	-5.038506	0.0000*	-0.014274	-0.300481	0.7001
IMPA	0.032805	0.527479	0.5979	0.038043	1.254775	0.4919
Market Cap	0.332830	20.80669	0.0000	0.047149	4.905614	0.0110
Debt Equity Ratio	0.074791	4.893892	0.0000	0.0807291	3.099789	0.0000
Number of Employees	0.476940	19.41300	0.0000	0.113293	6.177816	0.0000
R-squared	0.564891			0.507362		
Adjusted R-squared	0.552365			0.491443		
S.E. of regression	0.644856			1.011378		
F-statistic	342.3248			112.7524		
Prob(F-statistic)	0.000000			0.000000		

Note: *significant at 5% significance level

The p-value that corresponds to t = -9.109111 (post 5 years) and t = -3.312818 (post 10 years) for the variable Functional Scope is 0.0000 and 0.0196 respectively. The p-value that corresponds to t =-4.094570 (post 5 years) and t = -2.601968 (post 10 years) for the variable Physical Scope is 0.0000 and 0.9233 respectively. The p-value that corresponds to t = -3.895080 (post 5 years) and t -0.687391 (post 10 years) for the variable Consultancy Services is 0.0001 and 0.8193 respectively. The p-value of Customisation Level that corresponds to t = -5.038506 (post 5 years) and t = -0.300481 (post 10 years) for the variable Consultancy Services is 0.0000 and 0.7001 respectively. Since the $p<.05$ in the post 5 years of Functional Scope, Physical Scope, Consultancy Services and Customisation Level on CGS, and the $P<0.05$ in the post 10 years of FNP, the study failed to accept those null hypotheses. The study also identified a negative relationship between the CSFs which have a significant relationship with CGS.

Here Adjusted R^2 reveals that 55.24% variance in the CGS in the post 5 years is dependent on the identified CSFs in the process of ERP implementation but it decreased to 49.144% in the post 10 years. However, the data of both periods fit the regression model, and both are statistically significant.

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the CGS where $F(P) <0.05$, in both periods. So, the study concludes that the all the predictor variables are jointly significant.

7.3.5 Impact: CSFs on Asset Turnover Ratio (ATR)

The significant relationship of the CSFs: Functional Scope, Physical Scope, ERP Package Vendor, Consultancy Services, Customisation Level and Implementation Approaches with ATR in the post 5 years and 10 years of ERP implementation are analysed by formulating the following hypotheses and tested below.

The following hypotheses are used to test the impact of CSFs on ATR in the post 5 years

H0: There is no significant impact of functional scope on ATR

H0: There is no significant impact of Physical Scope on ATR

H0: There is no significant impact of ERP Package Vendor on ATR

H0: There is no significant impact of Consultancy Services on ATR

H0: There is no significant impact of Customisation Level on ATR

H0: There is no significant impact of Implementation Approaches on ATR

The following hypotheses are used to test the impact of CSFs on the ATR in the post 10 years

H0: There is no significant impact of Functional Scope on ATR

H0: There is no significant impact of Physical Scope on ATR

H0: There is no significant impact of ERP Package Vendor on ATR

H0: There is no significant impact of Consultancy Services on ATR

H0: There is no significant impact of Customisation Level on ATR

H0: There is no significant impact of Implementation Approaches on ATR

Table 7.5

Impact: CSFs on Asset Turnover Ratio (ATR)

Variables	Post 5 years			Post 10 years		
	Coefficient	**t-Statistic**	**Prob.**	**Coefficient**	**t-Statistic**	**Prob.**
Constant	1.549499	18.41214	0.0000	0.985894	11.07680	0.0000
FNS	0.034510	1.789443	0.0737	-.476991	-1.010007	0.7501
PHS	0.065541	2.618133	0.0389*	0.062650	2.467692	0.0137*
EPV	0.100143	1.906854	0.0932	-0.021405	1.077045	0.2816
CNTS	-0.046935	1.411871	0.0660	-0.054352	-1.515355	0.1298
CTL	0.117376	3.598191	0.0003*	0.046527	1.318154	0.1876
IMPA	0.082289	1.281637	0.7010	-0.047580	-1.873747	0.0611
Market Cap	0.081745	8.607390	0.0000	0.032226	3.762267	0.0002
Debt Equity Ratio	-0.014932	-1.496131	0.0348	-0.012948	-1.591799	0.0419
Number of Employees	0.031669	2.108491	0.0351	-0.031186	-2.441678	0.0147
R-squared	0.090283			0.042406		
Adjusted R-squared	0.073271			0.061067		
S.E. of regression	0.588773			0.603798		
F-statistic	5.307130			2.488749		
Prob(F-statistic)	0.000000			0.000001		

Note: *significant at 5% significance level

The p-value that corresponds to t =2.618133 (post 5 years) and t = 2.467692 (post 10 years) for the variable Physical Scope is 0.0389 and 0.0137 respectively. The p-value that corresponds to t 3.598191 (post 5 years) and t 1.318154 (post 10 years) for the variable Customisation Level is 0.0003 and 0.1876 respectively. Since the p<.05 in the post 5 years of Physical Scope and Customisation Level on ATR, and the P<0.05 in the post 10 years of Physical Scope, the study failed to accept those null hypotheses.

Here Adjusted R^2 reveals that only 7.33% variance in the ATR in the post 5 years is dependent on the identified CSFs in the process of ERP implementation and it is decreased to 6.10% in the post 10 years. However, as R^2 is greater than 0%, it can conclude that there is a statistically significant explanatory power in the Regression model.

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the ATR where F(P) <0.05, in both periods. So, the study concludes that the all the predictor variables are jointly significant.

7.3.6 Impact: CSFs on Debtors Turnover Ratio (DTR)

To identify the significant relationship of the CSFs: Functional Scope, Physical Scope, ERP Package Vendor, Consultancy Services, Customisation Level and Implementation Approaches on DTR in the post 5 years and 10 years of ERP implementation in the selected organisations are analysed by formulating and testing the following hypothesis.

The following hypotheses are used to test the impact of CSFs on DTR in the post 5 years

H0: There is no significant impact of functional scope on DTR
H0: There is no significant impact of physical scope on DTR
H0: There is no significant impact of ERP package vendor on DTR
H0: There is no significant impact of consultancy Services on DTR
H0: There is no significant impact of customisation Level on DTR
H0: There is no significant impact of implementation approaches on DTR

The following hypotheses are used to test the impact of CSFs on the DTR in the post 10 years

H0: There is no significant impact of Functional Scope on DTR

H0: There is no significant impact of Physical Scope on DTR

H0: There is no significant impact of ERP Package Vendor on DTR

H0: There is no significant impact of Consultancy Services on DTR

H0: There is no significant impact of Customisation Level on DTR

H0: There is no significant impact of Implementation Approaches on DTR

Table 7.6

Impact: CSFs on Debtors Turnover Ratio (DTR)

Variables	Post 5 years			Post 10 years		
	Coefficient	**t-Statistic**	**Prob.**	**Coefficient**	**t-Statistic**	**Prob.**
Constant	1.78548	1.183765	0.2366	6.29648	1.022382	0.3067
FNS	2.517736	4.227612	0.0000*	0.542783	4.180257	0.0000*
PHS	1.601004	2.375192	0.0176*	0.804628	1.387094	0.1656
EPV	.64075	0.990353	0.3221	40.12886	0.998205	0.3183
CNTS	.327200	1.219977	0.2226	-20.24553	-0.958867	0.3377
CTL	-.55960	-0.951321	0.3415	11.52502	1.236013	0.2166
IMPA	-.97720	-1.113614	0.2656	-15.67402	-1.129354	0.2589
Market Cap	5.631185	2.039650	0.0415	1.364115	1.459252	0.1446
Debt Equity Ratio	-1.210039	-0.439980	0.7532	-1.171367	-0.392682	0.6946
Number of Employees	-3.052545	-0.983693	0.3254	-8.474955	-1.171520	0.2415
R-squared	0.099825			0.078553		
Adjusted R-squared	0.091146			0.071089		
S.E. of regression	0.930053			.966365		
F-statistic	12.081633			10.062366		
Prob(F-statistic)	0.003196			0.005778		

Note: *significant at 5% significance level

The p-value that corresponds to t =4.227612 (post 5 years) and t = 4.180257 (post 10 years) for the variable Functional Scope is 0.0000 and 0.0000 respectively.

The p-value that corresponds to *t* =2.375192 (post 5 years) and t= 1.387094 (post 10 years) for the variable Physical Scope is 0.0176 and 0.1656 respectively. Since the p<.05 in the post 5 years of Functional Scope and Physical Scope on DTR, and the P<0.05 in the post 10 years of Functional Scope, the study failed to accept the corresponding null hypotheses.

Here Adjusted R^2 reveals that only 9.11% variance in the DTR in the post 5 years is depend on the identified CSFs in the process of ERP implementation and it is decreased to 7.11 % in the post 10 years. However, as R^2 is greater than 0%, it can conclude that there is a statistically significant explanatory power of the Regression model

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the ROA where F(P) <0.05, in both. So, the study concludes that the all the predictor variables are jointly significant.

7.3.7 Impact: CSFs on Inventory Turnover Ratio (ITR)

The study is required to know whether there is any significant relationship between the selected CSFs: Functional Scope, Physical Scope, ERP Package Vendor, Consultancy Services, Customisation Level and Implementation Approaches on ITR in the post 5 years and 10 years.

The following hypotheses are used to test the impact of CSFs on ITR in the post 5 years.

H0: There is no significant impact of functional scope on ITR
H0: There is no significant impact of Physical Scope on ITR
H0: There is no significant impact of ERP Package Vendor on ITR
H0: There is no significant impact of Consultancy Services on ITR
H0: There is no significant impact of Customisation Level on ITR
H0: There is no significant impact of Implementation Approaches on ITR

The following hypotheses are used to test the impact of CSFs on the ITR in the post 10 years

H0: There is no significant impact of Functional Scope on ITR

H0: There is no significant impact of Physical Scope on ITR

H0: There is no significant impact of ERP Package Vendor on ITR

H0: There is no significant impact of Consultancy Services on ITR

H0: There is no significant impact of Customisation Level on ITR

H0: There is no significant impact of Implementation Approaches on ITR

Table 7.7

Impact: CSFs on Inventory Turnover Ratio (ITR)

Variables	Post 5 years			Post 10 years		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
Constant	12.43871	2.831749	0.0047	9.435337	1.831452	0.0672
FNS	0.394473	2.906261	0.0047*	0.262038	2.100261	0.0497*
PHS	0.513038	2.921657	0.0204*	0.163107	2.188835	0.0287*
EPV	-0.209626	-0.610719	0.5414	-0.430869	-0.929419	0.3528
CNTS	0.076991	4.010007	0.0001*	0.545459	1.634791	0.1022
CTL	-0.100143	-2.946854	0.0032*	-0.916271	-1.860397	0.0630
IMPA	0.261528	1.259491	0.2080	0.329033	1.438162	0.1505
Market Cap	-0.316523	-0.611087	0.5412	0.313328	2.402507	0.0164
Debt Equity Ratio	0.001339	0.003412	0.9973	0.211339	0.113412	0.1093
Number of Employees	-0.537007	-4.034327	0.0001	0.264911	0.454775	0.6493
R-squared	0.522010			0.419008		
Adjusted R-squared	0.486272			0.399891		
S.E. of regression	0.171857			0.147685		
F-statistic	16.890321			14.98447		
Prob(F-statistic)	0.000000			0.000300		

Note: *significant at 5% significance level

The p-value that corresponds to *t* = 2.906261 (post 5 years) and t = 2.100261 (post 10 years) for the variable Functional Scope is 0.0047 and 0.0497 respectively. The p-value that corresponds to *t* =2.921657 (post 5 years) and t = 2.188835 (post 10 years) for the variable Physical Scope is 0.0204 and 0.0287 respectively. The p-value that corresponds to t = 4.010007 (post 5 years) and t = 1.634791 (post 10 years) for the variable Consultancy Services is 0.0001 and 0.1022 respectively. The p-value of Customisation Level that corresponds to t = 2.946854 (post 5 years) and t = -1.860397 (post 10 years) for the variable Customisation Level is 0.0032 and 0.0630 respectively. Since the $p<.05$ in the post 5 years of Functional Scope, Physical Scope, Consultancy Services and Customisation Level on ITR, and the $P<0.05$ in the post 10 years of Functional Scope and Physical SCcope, the study failed to accept the corresponding H0. There found a negative significant relationship between Customisation Level and ITR in the post 5 years of implementation and a positive significant relationship between Functional Scope and ITR, Physical Scope and ITR in both periods. But regarding Consultancy Services there found a positive significant relationship with ITR only in the immediate post 5 years of ERP implementation.

Here Adjusted R^2 reveals that 48.62% variance in the ROA in the post 5 years is dependent on the identified CSFs in the process of ERP implementation but it decreased to 39.99% in the post 10 years. Hence, the data of both periods shows a statistically significant explanatory power in the Regression model.

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the ROA where $F(P) <0.05$, in both periods. So, the study concludes that the all the predictor variable are jointly significant.

7.3.8 Impact: CSFs on Fixed Asset Turnover (FAT)

In this section, the study is analysing whether there is any significant relationship between the selected CSFs: Functional Scope, Physical Scope, ERP Package Vendor, Consultancy Services, Customisation Level and Implementation Approaches in the process of ERP implementation on FAT of the organisations in the post 5 year and post 10 years of ERP implementation. The regression result generates the result of the impact of these CSFs on FAT. The below hypotheses are formulated to test the relationship between these CSFs and FAT.

The following hypotheses are used to test the impact of CSFs on FAT in the post 5 years

H0: There is no significant impact of functional scope on FAT

H0: There is no significant impact of Physical Scope on FAT

H0: There is no significant impact of ERP Package Vendor on FAT

H0: There is no significant impact of Consultancy Services on FAT

H0: There is no significant impact of Customisation Level on FAT

H0: There is no significant impact of Implementation Approaches on FAT

The following hypotheses are used to test the impact of CSFs on the FAT in the post 10 years

H0: There is no significant impact of Functional Scope on FAT

H0: There is no significant impact of Physical Scope on FAT

H0: There is no significant impact of ERP Package Vendor on FAT

H0: There is no significant impact of Consultancy Services on FAT

H0: There is no significant impact of Customisation Level on FAT

H0: There is no significant impact of Implementation Approaches on FAT

Table 7.8

Impact: CSFs on Fixed Asset Turnover (FAT)

Variables	Post 5 years			Post 10 years		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
Constant	11.66697	5.695808	0.0000	14.98677	5.240085	0.0000
FNS	1.201496	3.012625	0.0026*	-.078513	1.041493	0.5024
PHS	1.469429	2.195882	0.0282*	1.520939	2.087969	0.0488*
EPV	-0.571139	-1.414269	0.6017	-0.420921	-1.139213	0.8706
CNTS	8.674716	1.376548	0.1688	7.982609	1.402535	0.1609
CTL	-23.365825	-1.179373	0.2384	-20.81108	-1.171737	0.2414
IMPA	-0.877540	-1.428219	0.1534	-0.543568	-1.272356	0.2178
Market Cap	1.079000	6.705260	0.0000	0.936667	10.07196	0.0000
Debt Equity Ratio	-0.156991	-1.580242	0.1142	-0.200838	-2.284076	0.0225
Number of Employees	-2.112903	-5.254683	0.0000	-4.285394	-2.230405	0.0000
R-squared	0.088441			0.087026		
Adjusted R-squared	0.091395			0.070781		
S.E. of regression	9.958919			9.962212		
F-statistic	5.188375			5.357074		
Prob(F-statistic)	0.000000			0.000000		

Note: *significant at 5% significance level

The p-value that corresponds to t = 3.012625 (post 5 years) and t = 1.041493 (post 10 years) for the variable Functional Scope is 0.0026 and 0.5024 respectively. The p-value that corresponds to t =2.195882 (post 5 years) and t = 2.087969 (post 10 years) for the variable Physical Scope is 0.0282 and 0.0488 respectively. Since the p<.05 in the post 5 years of ERP implementation regarding Functional Scope and Physical Scope and the P<0.05 in the post 10 years of FNP, the study failed to accept the corresponding null hypotheses. The study identified a positive significant relationship between FNP and FAT and also Physical Scope and FAT.

Here Adjusted R^2 reveals that 9.144% variance in the FAT in the post 5 years is dependent on the identified CSFs in the process of ERP implementation but it decreased to 7.08% in the post 10 years. However, the data of both shows a statistically significant explanatory power in the Regression model.

According to the F-statistic, the CSFs in the process of ERP implementation were useful in predicting the ROA where $F(P) < 0.05$, in both periods. So, the study concludes that the all the predictor variables are jointly significant.

7.4 Summary

This chapter of the study analysed the impact of CSFs on the financial performance of the organisation. The Regression model is used to analyse the impact. It has been found that the ROA of the organization was changed due to the CSFs Consultancy Services and Customisation Level in the post 5 years of ERP implementation. But these CSFs is not showing any significant relationship with ROA in the post 10 years of ERP implementation. Regarding ROS the CSFs, Consultancy Services made a significant effect on ROS in both post 5 years of ERP implementation and the post 10 years of implementation. But the significant relationship of Customisation Level with ROS was there only in the post 5 years of implementation. In the post 5 years there found a significant relationship of CSFs: Functional Scope, Physical Scope, Consultancy Services, Customisation Level with SG&A but the significant relationship is there only with Functional Scope in the post 10 years. In the case of CGS and ITR, the study received the same result as that of SG&A. The study identified a significant relationship between Physical Scope and ATR in both post 5 years and 10 years, but there was found to be a significant relationship of Customisation Level with ATR only in the post 5 years of implementation. The DTR is influenced by the CSFs, Functional Scope and Physical Scope. But only Functional Scope made a significant relationship in both periods. The Physical Scope affected only in the post 5 years of implementation. Regarding FAT, the CSF, Physical Scope made a significant relationship in both periods taken for the study, but Functional Scope made a significant relationship only post 5 years of implementation. The study identified that the selected CSFs as a whole impact the financial performance in both 5 years of ERP implementation and post 10 years of ERP implementation.

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Chapter Eight

SUMMARY, FINDINGS, DISCUSSION AND CONCLUSION

8.1 Introduction

The purpose of the study was the identification of the CSFs in the process adopted by the manufacturing sector in India for the implementation of ERP systems, to know its impact on the capability of the organisation and its financial performance, as well as its influence on the ERP implementation cost and time. Following a detailed study of the literatures on ERP, experts' opinion and by analysing the data obtained from primary and secondary sources, this chapter gives the summary of the research work, the finding on the research objectives, discussion of the findings and finally the conclusion of the research work.

SECTION A

8.2 Summary

The study examined in detail the impact of CSFs in the process of ERP implementation on the organisational capability and the financial performance of the listed large and medium manufacturing enterprises in Maharashtra, Tamil Nadu and Gujarat, which are the top three industrial states of India.

8.2.1 Objectives of the study

The identification of research Gap made way to the identification of the four objectives of the study. The objectives of the research were a. To identify the CSFs in the process of ERP implementation. b. To identify the impact of CSFs on the time and cost of ERP implementation. c. To identify the impact of CSFs on the capability of the organisation. d. To identify the impact of CSFs on the financial performance of the firm.

8.2.2 Research Methodology

The research is both descriptive and empirical in nature. The researcher developed a comprehensive questionnaire and categorised them into two: one is to get data regarding the CSFs, which is collected from the ERP experts and the other is for the General Managers of enterprises to get data on the impact aspect of the study. The researcher finalised the sample size to 160 with Inverse Square root method and collected the primary data through purposive sampling technique. The data from the survey failed the assumption of normality. Hence, nonparametric tests were used to analyse the data. The study used sophisticated statistical tools like SPSS, PLS SEM and MS Excel for data analysis. The basic statistics like percentages and quartiles were used and also Kruskall Wallis test, Mann whitening U, Dunn test for pairwise comparison and PLS SEM to study the impact on Organisational capability. The study used MS excel tools for regression analysis, to find the impact of ERP implementation on financial performance.

8.2.3 Chapter Summary

The **first chapter** is the introduction chapter, which discussed the research problem, the scope and significance of the study, the study's objectives, variables, conceptual model, operational definitions, the research period, the research methodology, and the study's limitations.

In the **second chapter**, the abstracts of reviews on literature and research gaps were discussed. For the purpose of reviewing the literatures, the study focused on the literatures on ERP/IS implementation process, CSFs of ERP implementation, Case studies of various organisations and impact of ERP/IS both in financial and non-financial terms. From the reviews of both national and international literatures on ERP. The study finalised the research gap in the second chapter.

The **third chapter** provided an overview of the ERP implementation. This chapter presented ERP definitions, the need of ERP, Evolution of ERP, various ERP vendors, the ERP market, type or approaches of ERP implementation, Modules of ERP, ERP market (International and National), ERP implementation cost, issues and challenges in ERP implementation and most importantly the theoretical base of the study. The four theories which formed the foundation of the present study were the Process theory, the Stages theory, the De Lone and McLean Model of Information Systems Success, and the Value Triangle.

From the **fourth chapter** onwards, the study attempted to focus on the research objectives. The first objective of the study was prepared and concluded based on the literatures available as well as ERP expert advice. From the comprehensive literature review, the study identified the three phases of ERP implementation and the process adopted by the organisation in each phase of the ERP roll out. Then identified the study, the CSFs while implementing ERP system. The validation of the variables using PLS SEM, the study finalised the sixteen CSFs for the research process.

The **fifth chapter** which focused on the second objective gives the profile of the respondent enterprises and impact analysis of CSFs on the ERP implementation Project time and project cost. Kruskal Wallis Test, Dunn test and Mann – Whitney ‘U’ statistic were used to determine the differences in the independent variables caused by the changes in the CSFs in the process of ERP implementation opted by the selected enterprises. The study found that even the differences in the CSFs cause variations in the project time, only the CSF, the implementation approaches caused a statistically significant difference in the project time. The CSFs: physical scope, vendor viability, consultant viability, end-user training, customisation level, consultancy services and system testing, individually made impact on the project cost and the variations in the project time also made differences in the project cost. Finally, it was determined that the implementation approaches were the only CSFs that significantly altered the ERP implementation time. Regarding project cost the study found that the variations in CSFs have an impact on the ERP implementation cost.

The next part of the study focused on the impact of CSFs on the organisational capability and its components, which was presented in the **sixth chapter**. Kruskal Wallis Test, Dunn test and Mann – Whitney ‘U’ statistic were used to determine the differences in the organisational capability and its components with the differences in the CSFs. From the PLS SEM, it was found that the CSFs had a strong association with the organisational capability and its components. vendor scalability, consultant scalability, resource mobilisation, BPR, customisation level and system upgradation have a vital role to make a statistically significant impact on organisational capability. Regarding the components of organisational capability, vendor viability, vendor scalability, consultant scalability and resource mobilisation made a statistically significant difference in inbound logistics. vendor scalability, consultant scalability, resource mobilisation, BPR, customisation level, data migration, system testing and system upgradation had a statistically significant difference in operational excellence. vendor scalability, consultant scalability and resource mobilisation made a statistically significant difference in decision making and finally resource mobilisation, BPR, end-user training, system testing and system upgradation made a statistically significant difference in Strategic Impact. The model fit was determined based on PLS SEM results. The chapter concludes that the CSFs in the ERP implementation process had a significant impact on the organisational capability.

After analysing the differences in the organisational capability and its components due to the CSFs in the process of ERP implementation, the **seventh chapter** of the study attempted to analyse the impact of CSFs on the Financial performance of the organisation in the 10 years following ERP implementation by comparing it to the financial performance of the preceding 10 years. The study also made a comparison of financial performance between the result of five years of post-ERP implementation and ten years of ERP post implementation to identify any change in the financial performance of the firms. The study examined the financial performance indicators Return on Asset (ROA), Return on Sale (ROS), Selling, General and Administrative Expenses (SG&A), Cost of Goods Sold (CGS), Asset Turnover Ratio (ATR), Debtors Turnover Ratio (DTR), Inventory Turnover Ratio (ITR) and Fixed Asset Turnover Ratio (FAT) to determine if the CSFs had a significant impact on the financial performance of the organisation during the selected period. The regression result indicated that the financial performance of the selected organisations had changed significantly due to the impact of the CSFs in the process of ERP implementation.

SECTION B

8.3 Findings

The findings of the study are classified in the order in which they pertain to the research objectives. Thus, this section presents findings under four heads: first: regarding the first objective, ERP implementation Process and the CSFs, Second: impact of CSFs on the time and cost of ERP implementation, third: impact of CSFs on the organisational capability and fourth: the impact of CSFs on the financial performance.

8.3.1 Objective 1 – To Identify the CSFs in the Process of ERP Implementation

1. From the literatures, it was found that there are differences in establishing the role of CSFs in particular phases in the process of ERP implementation. For example, sometimes the organisations conduct evaluation of vendor after considering the project scope or sometimes before deciding the project scope, similarly the end user training may be conducted before the implementation or during implementation or even along with the life of the project. So, in order to get more clarity, the study classified the process of ERP implementation into the basic three phases of implementation classification, i.e., the pre-implementation phase, the implementation phase and the post implementation phase.

2. The study identified 18 independent variables as the CSFs from the literatures on ERP implementation and as per the opinion of the subject experts. Two factors configuration and system integration were removed as the reliability of the variables was below the minimum required value suggested by Hair et al., (2011). Finally, the study reduced the independent variables into 16 and finalised the factors for finding the impact of ERP implementation.

3. The identified 16 variables are arranged under the identified ERP implementation process form the literatures and expert opinion. These variables are given in the table 8.1.

Table 8.1

ERP implementation process and CSFs

ERP Implementation Phases	ERP Implementation process	CSFs
Pre-Implementation Phase	Vendor Evaluation	Vendor Viability and Vendor Scalability
	Consultant Evaluation	Consultant viability and consultant scalability
	Organisational Readiness	Resource mobilisation, Business Process Reengineering and End User training.
	Project Scope	Functional Scope and physical scope
	Software Readiness	ERP Vendor, Customisation Level and Consultant Services
Implementation Phase	Software Readiness	Implementation Approaches
	Information System Readiness	Data Migration and System Testing
Post-implementation Phase	Information System Readiness	System Upgradation

❖ **Findings on CSFs**

1. The study accepted the responses from only those organisations, which had adopted at least one value chain module and dropped the firms which only adopted the enterprise support modules without any value chain modules. It was found that 36.87% of the companies adopted almost all significant modules of ERP like manufacturing, finance, industry-specific module, project management, HRM, operations, sales and distribution and customer relationship modules.

   26.25% of the respondents implemented only the core modules of ERP i.e. manufacturing module, finance module and industry-specific module.

26.88% of the organisations selected the human resource module or/and project management module along with the core modules.

It was found that only 10% of the companies implemented only one ERP module and which is a value chain module. i.e. materials management, operations module, sales and distribution etc.

2. SAP is the major ERP vendors in India and globally. The research found that the majority (75%) of the organisations in the sample are using SAP for ERP solutions followed by People Soft (15%). SSA Baan and Ramco ERP 6.88% (3.13%) organisations are using respectively.

3. 12.5% of the companies implemented ERP in their entire branches and it includes companies having 20 to 30 branches. 28.7% of the companies have 11 to 20 branches and they implemented the ERP in the whole branches. Majority of the organisations, i.e. 50.6%, had 1 to 10 branches and ERP was implemented in them. 8.1% of the companies implemented ERP package in their main plant only and not in any of their branches.

4. Vendor evaluation was done by analysing the efficiency in vendor viability and vendor scalability. 58.1% respondents indicated that they adopted vendors with average viability, 21.9% of them were poor in that and only the remaining 20% have highly viable

   But regarding the efficiency in scalability, the majority of the vendors (41.9%) were highly efficient, 39.4% were average and only the remaining 18.8% showed a poor scalability efficiency.

5. The study evaluated the consultant efficiency by analysing their efficiency in scalability and viability. 39.06% of the respondent organisation's had consultants with poor viability, 28.13% were average and 32.81% have high viability.

But regarding the efficiency in evaluating consultant scalability, 42.97% of the consultants had poor scalability, 30.47% were highly efficient in that and the remaining 26.56% showed an average efficiency.

6. The level of customisation opted by the organisation was divided into four: zero customisation, minor customisation (customisation level 1-10%), moderate customisation (11 to 25%) and major customisation (customisation level 26 to 50%).

   It was found that 30.63% (majority) organisations in the sample opted zero customisation followed by Moderate customisation (28.75% companies), Minor customisation (21.25% companies) and Major customisation (19.38% companies) respectively.

7. Most of the organisations i.e., 80%, used the service of consultants for ERP implementation and maintenance and only the remaining 20% implemented ERP solutions without adopting the services from ERP consultants.

8. The organisations in the sample implemented ERP through three different ways. The big bang approach was used by 58.75% of the organisations to implement the ERP full package in the entire branches of the organisation. 31.25% of the selected companies opted module wise implementation by implementing a single or couple of modules at a time. 10% of the companies opted to implement the entire modules in a single or couple of branches.

9. Before implementing the ERP software, it is essential to ensure the organisational readiness to implement the package. The study determined the readiness of the organisations by analysing the efficiency in resource mobilisation, BPR and end-user training.

   It was found that 38.8% of the organisations were highly efficient in mobilising resources followed by 30.6% with average and 30.6% with poor efficiency.

47.5% of the organisations showed an average efficiency in BPR, 27.5% of them had highly efficient BPR and 25% had poor efficient BPR.

Regarding efficiency in end-user training, 43.8% of the organisations were highly efficient, followed by 30.6% and 30.6% with average and poor efficiency respectively.

10. Like organisational readiness, it is essential to make the existing information system ready to adopt the new system for its proper implementation and maintenance. It was done through analysing the efficiency in data migration, system testing and system upgradation.

    The study identified that 42.5% of the organisations showed average efficiency in migrating data from the legacy system to the new system. 30.6% and 26.9% shows high and poor efficiency respectively.

    41.9% of the organisations had an average efficiency in system testing. 31.3% and 26.9% had high and poor efficiency respectively.

    47.5% of the organisations had average efficiency in system upgradation while 27.5% and 25.0% had high and poor efficiency respectively.

8.3.2 Objectives 2 – To Identify the Impact of CSFs on the Time and Cost of ERP Implementation

A. CSFs on project time

1. The organisations in the sample adopted 3 major ways to implement ERP. One is the big bang approach, next is the module wise approach and the third is branch wise implementation. It was found that none of the independent variable made any difference in the ERP implementation duration except implementation approaches. The ERP implementation duration was affected by differences in implementation approaches *($B = 0.221$, $p = 0.039$ $t = 2.082$).* From the pairwise comparison, the study found that the project time is much higher in the firms which opted branch wise rollout of ERP implementation (Mean rank 107.22) than those which opted the big bang approach (Mean rank

76.03). The organisations took lesser time for implementation with big bang approach and more time for branch wise implementation and an average time for module wise implementation.

B. CSFs on project cost

1. The study identified that the difference in the number of ERP implemented branches (physical scope) of each organisation made a significant difference in the cost of ERP implementation (B =.506, p = .008 t = 2.672). From the pairwise comparison, the study found a significantly higher implementation cost in those organisations which implemented ERP in more than 20 branches while comparing it with the organisations which implemented ERP in less than 20 branches. The mean rank also showed that the project cost increases as the number of ERP implemented branches increases.

2. The test result indicated that the viability of the vendor and the consultant had made a significant difference in the cost of the ERP implementation. As the viability of the vendor and consultant increases the cost of the project also increases.

3. The efficiency of the training provided to the users of the new ERP system by the organisation made a significant difference in the cost of the ERP implementation (B = *0*.**830**, p = *0*.**000** t = **6.325)**. To determine the impact of the difference in the efficiency of the training on the project cost, the study categorised the training efficiency into three and the study identified that as the training efficiency is high, the cost of the project also seems to be high and it is low when efficiency decreases. Hence, the study concluded that the high efficiency training programs organised by the organisations faced higher cost comparing to the organisations which provided average and poor efficient training to the end users of ERP.

4. In most of the organisation, the level of customisation has a major role in the ERP implementation cost. Hence, the study came to the same conclusion that, when the level of customisation increases the cost of the project also increases

(*B* =*0*.**462**, *p* = *0*.**002***t* = **3.230)**. The Dunn test shows that the project cost is high when there is 26 to 50% of customisation (Mean rank 113.85) when comparing to the customisation level of 11 to 25% (Mean Rank 83.62) and zero customisation (Mean Rank 35.97).

5. Like customisation level, consultancy services also have a significant role in the cost of ERP implementation. In the study, there were 128 organisations which adopted the service of the consultant and the remaining used their in-house potentials in ERP implementation. (*(B* = **.220**, *p* = **.003** *t* = **3.035)**. From the pairwise comparison and the mean rank the study interprets that the cost of the project was higher in the organisations which adopted the consultant service in comparison with those who had not adopted the services.

6. Inefficiency in system testing conveys wrong results, which causes failure of ERP implementation project and sometimes inefficiency give way to repetition of testing the system again and again incurring additional cost for ERP implementation. The result of the study indicated the same result, that the organisations which performed an inefficient ERP system testing before going live made a big impact on the cost of the ERP project. The organisations which showed high efficiency in system testing required less cost compared to the organisations which made an inefficient system testing process. (*(B* =*0*.**220**, *p* = **.003** *t* = **3.035).**

7. Like every other project in ERP implementation, it was found that, the longer the time taken for the project higher will be the cost. There exists a positive correlation between project time and project cost. (*(B* =*0*.**619**, *p* = *0*.**008)**. The project time got a mediating role on increasing the project cost directly regarding the CSFs, consultancy services, customisation level, and organisational readiness and indirectly regarding the CSFs, consultancy services, customisation level, physical scope and organisational readiness.

8.3.a Findings Summary: ERP implementation-CSFs on Project Time and Project Cost

Table 8.2

Findings Summary: Impact- CSFs on Project Time and Project Cost

CSFs	Project time	Project cost
FNP		
PHS		*
VDV		*
VDS		
CTV		*
CTS		
EPV		
CTL		*
CNTS		*
IMPA	*	
RMO		
BPR		
EUT		*
DMG		
STG		*
STU		
R^2	0.906	0.941

Note: The symbol '*' denotes the CSFs whose difference results in a significant difference in the project time and Cost

The above table 8.2, highlighted the CSFs which made a significant difference in the duration and cost of an ERP implementation project. It was found that only the CSF, implementation approaches made a significant difference in the ERP implementation project duration. Meanwhile, the cost of ERP implementation project varied significantly due to seven CSFs: physical scope (No. of ERP implemented Branches), vendor viability, consultant viability, customisation level, adoption and not adoption of consultancy services, end-user training efficiency and system testing efficiency.

8.3.3 Objective 3 – To Identify the Impact of CSFs on the Organisational Capability

A. CSFs on Organisational Capability

1. The efficiency level of the consultant and vendor can sometimes make the ERP implementation success or failure. From the study, it was identified that the efficiency level of the consultant positively affected the capability of the organisation (*(B =0***.125***, t=10.994, p =.* **008)**. In evaluating the efficiency, the study considered the viability and scalability of the consultant. Even there are variations in the organisational capability due to changes in Vendor and consultant viability, it is not showing a statistically significant impact, but the efficiency in scalability showed a statistically significant impact. There was an increase in the capability of the organisation which opted for a consultant with higher efficiency in scalability comparing to the consultant with average and lower efficiency in scalability. The more efficient an ERP consultant more is the success.

2. Like consultant, the vendor with high potential in scalability made a significant difference in the capability of the organisation in comparison with vendors with average and low efficiency in scalability of the ERP system.

3. Before ERP implementation, the organisation should prepare properly for the success of ERP implementation. The more efficient the organisation in making them ready for implementing the software the more will be the result. Here, the study found that the efficiency in making the organisation ready for adopting the ERP implementation made a positive impact on the capability of the organisation *(B =0***.19***, t=6.181, p = 0***.000)**. The organisational readiness was analysed by the level of efficiency in BPR, mobilising resources and training programs to the end users.

It was found that the capability of the organisation changed significantly due to the efficiency in mobilising resources and efficiency in reengineering the existing business process to adopt the new system as the $p<0.05$. The organisational capability has a positive relationship with the efficiency in resource mobilisation and BPR. Mean rank shows that the higher the efficiency in resource mobilisation and BPR that the higher the organisational capability.

4. Depending upon the requirements of the organisation, the ERP providers make alterations in their software packages to make it more customised. The result indicates that there is difference in the capability of the organisation with changes in the level of customisation. *(B =0*.**309**, *t=2.779, p =* **.000)**. The result of the mean rank indicates that the capability of the organisation is high when there is minor customisation (customisation level 1-10%) and it decreased at moderate level of customisation (customisation level 11-25%) but the organisational capability is very low at zero customisation and when there is very high level of customisation (customisation level 26-50%)

5. The organisation which is considering the upgradation of ERP system and are efficient in upgrading the ERP system effectively influences the organisational capability positively than the organisations which are not efficient enough in the upgradation of the implemented ERP system. The pairwise comparison result indicates that when the efficiency level of upgrading the ERP system increases the capability of the organisation also increases, and it decreases when the efficiency level decreases.

6. The organisations take decisions to implement a particular ERP module as per their functional requirements. From the study, it was found that the Functional Scope of the project did not make any impact on the overall organisational capability as the $p>0.05$. But from the mean rank it was found that the firm which implemented the core modules and HR and/or PM modules have gained in organisational capability in comparison with firms that implemented single value chain module, core modules and even the entire modules (full ERP

package). As a whole it is found that there is no statistically significant difference in the capability of the organisation due to difference in the modules implemented by the organisations.

7. Like changes in the modules made no variations in the organisational capability it was found that the differences in the number of ERP implemented branches of each organisation, differences in the viability of vendor and consultant, adoption of consultancy services, differences in vendor selected and differences in implementation approaches, difference in end-user training, Data migration and system testing made no statistically significant difference in the capability of the organisations. Thus, it can be concluded that theses CSFs made no significant differences in the organisational capability ($P>0.05$).

B. CSFs and Components of Organisational Capability

The study analysed and identified the result of the impact of CSFs on the capability of the organisation. To get more reliable results, the study analysed the impact of the CSFs on the components of organisational capability. This section categorised factors into five as per the impact variables as inbound logistics Operations, outbound logistics Operations, operational excellence, decision making Capability and in the strategic impact.

CSFs on Inbound Logistics

1. From the test result, it was found that the ERP vendors scalability and viability significantly made a difference in the inbound logistics capability of the organisation as $p<0.05$ in both analyses. The mean rank illustrates that when the scalability efficiency and the viability of the vendor increases it directly enhanced the inbound logistics capability of the organisation and it decreases when the efficiency of vendors decreases. The pairwise comparison showed that the inbound logistics capability is higher in the organisations which opted the vendors with higher viability comparing to the vendors with poor viability. Like that, the inbound logistics capability is higher in the organisations with vendors having high efficiency in ERP scalability comparing to the average and poor efficient vendors regarding scalability.

2. It was found that there is a positive relationship exists between variation in consultant efficiency and inbound logistics (*(B =0***.289***, t=4.721, p = 0***.000**). As the level of consultant efficiency increased, it increases the inbound logistics capability of the organisation. The efficiency in viability and scalability are the two factors considered to evaluate the efficiency of the consultants. It was found that there is a statistically significant difference in inbound logistics capability with difference in consultant scalability. The Dunn test proves that the consultant with high efficiency in scalability accelerated the capability of the inbound logistics operations compared to the organisations that opted the consultant with average and poor efficiency regarding scalability.

3. The capability of inbound logistics was enhanced due to the proper and efficient preparation of the organisation for ERP implementation. There exists a positive relationship between the readiness of the organisation for implementing an ERP system and its inbound logistics capability (*B =0.572, t=14.102, p = 0*.000). The organisational efficiency was evaluated by the factors, efficiency in BPR, efficiency in end-user training and efficiency in resource mobilisation. From the mean rank the study found that, the more the efficiency in mobilising resources more will be the inbound logistics capability and it decreases as efficiency decreases. The pairwise comparison showed that the inbound logistics capability is higher in those organisations which have higher efficiency in mobilising resources for the proper implementation of the ERP system compared to the organisations with average and poor efficiency in that.

4. The Information system readiness is very significant in implementing the ERP system. Three factors were identified for analysing the impact of Information System Readiness on inbound logistics, which is carried out in two stages of ERP implementation. The data migration and system testing are carried out in the implementation stage and the system up gradation in the post implementation stage. While taking each CSFs individually, the study found that these CSFs did not make any significant difference in the inbound logistics operations of the enterprises but all together the three CSFs in information system readiness made a positive impact on the inbound logistics capability of the organisation (*B =0.*717*, t=7.391, p = 0.*000).

5. The difference in the number of ERP implemented branches, module implemented, viability of the consultant, vendor selected, customisation level, consultancy services, implementation approaches, BPR, end user training, data migration, system testing and system upgradation made no significant difference in the inbound logistics operational capability of the enterprises.

CSFs on Outbound Logistics

6. After testing the significant difference in the outbound logistics capability of the organisations with the difference in the different CSFs selected for the study, the study found all the factors made differences in the outbound logistics capability but none of them made a statistically significant difference. But from the model fitness using PLS SEM the study found that the efficiency of the consultant (*B =0.*289*, t=4.721, p = 0.*000), the organisational readiness (*B =0.572, t=14.102, p = 0.*000), the information system readiness (*B =0.717, t=7.391, p = 0.*000), and finally the level of customisation (*B =0.104, t=2.345, p = 0.*019), made a positive difference in the outbound logistics capability of the organisation.

CSFs on Operational Excellence.

Among the CSFs selected for the study, some of them made a significant difference in the outbound logistics. Here, the study presents those critical factors which made a significant difference in the operational excellence of the selected enterprises.

7. The difference in the scalability of the vendor and the consultant made a significant difference in the operational excellence of the organisations after

ERP implementation. The mean rank exhibited that, when the efficiency in scalability of vendor and consultant is higher, the organisation showed a higher operational excellence and decreased as the efficiency in scalability decreased. The organisations which adopted the vendor and consultant with high efficiency in scalability showed a higher degree of operational excellence while comparing the same with those of average and poor efficiency in scalability.

8. The organisation is required to make it ready for the implementation of ERP. They need to reconstruct or reengineer their business operations, they need to mobilise resources and to prepare their human resources to accept the new system move on without any confusions or conflicts. The study found that the efficiency in organisational readiness enhanced the operational excellence of the organisation ($B = 0.665$, $t = 9.644$, $p = 0.000$). The study used the CSFs, resource mobilisation, BPR and end-user training to measure the efficiency of organisational readiness. The test result is indicating that, the organisations which are excellent in mobilising resources and efficient in reengineering the business process for implementing the ERP system properly made a significant difference in the operational excellence of the organisation. Dunn test reveals that as the efficiency increases their excellence in business operation also improves. At higher-level efficiency in business process reengineering and resource mobilisation, the organisation attains higher level of operational excellence. It decreases as the efficiency decreases to the average level and to the lower level.

9. The customisation is carried out as per the requirements of the organisation. The study found that the variations in the level of customisation made changes in the operational excellence of the organisation ($B = 0.273$, $t = 4.226$, $p = 0.000$). From the mean rank, it was found that there is a poor impact on operational excellence at higher level of customisation compared to the other levels and it is higher at minimum level of customisation. Hence, the result is indicating that too much customisation is not a good choice as the organisation is getting better result even at minimum customisation than full-scale implementation.

10. Organisations must manage the information system for the effectiveness of ERP implementation. For measuring the information system readiness, the study analysed the significant difference in the operational excellence due to the differences in the efficiency in data migration, efficiency in system testing and efficiency in system upgradation. From the test result, the study found that there was a significant difference. The mean rank is indicating that as the efficiency in data migration, system testing and system up gradation increases the operational excellence also increases. Operational excellence decreases at average efficiency and poor efficiency in that order.

11. Even though there were significant differences in the operational excellence of the organisation due to the CSFs, Vendor and consultant scalability, customisation level, resource mobilisation, BPR, data migration, system testing, and system upgradation, there were no statistical significant differences in the operational excellence with respect to the CSFs, functional scope, physical scope, vendor and consultant viability, ERP package vendor, consultancy services, implementation approaches and end-user training.

CSFs on Decision-Making Capability

The CSFs in the process of ERP implementation made differences in the decision-making capability of the sample organisations. But only a few of them made a significant difference.

12. The inbound logistics capability, the operational excellence and the overall organisational capability showed a significant difference with the difference in scalability of the vendor and the consultant. The study found the same result while testing the significant difference of the decision-making capability of the organisation with the difference in the scalability of the vendor and the consultant as $p<0.05$. The mean rank is indicting that the decision-making capability is higher in the organisations which adopted the vendor and consultant with high efficiency in ERP scalability and it decreases when the scalability efficiency decreased to average and poor efficiency level respectively.

13. In order to prepare the organisation to implement ERP software the organisation is required to reconstruct or reengineer the existing business process; they need to provide sufficient training to the end users to make them comfortable with the new working system and more than that it is essential to gather enough resources for the smooth implementation and running of the new ERP system. These factors ultimately enhance the decision-making capability of the organisation. The PLS SEM result of the impact of organisational readiness on the decision-making capability of the organisation is indicating that there exists a strong positive relationship between the organisational readiness efficiency and the decision-making capability of the organisation (($B = 0.579$, $t=6.562$, $p = 0.000$). The Dunn test result reveals that the organisation with high efficiency in mobilising resources, reengineering business processes and providing training to end users for the ERP implementation showed a higher decision-making capability while comparing to average and low efficiency in that.

14. Thus, only vendor and consultant scalability and resource mobilisation efficiency made a significant difference in the decision-making capability of the organisation. The factors, functional scope, physical scope, vendor viability, consultant viability, ERP package vendor, customisation level, consultancy services, implementation approaches, BPR, end-user training, data migration, system testing and system upgradation made difference in the decision-making Capability of the organisation, but not statistically significant.

CSFs on Strategic Impact

From the study, it was found that some of the CSFs in the process of ERP implementation made significant differences in the strategic impact of ERP implementation.

15. The vendor efficiency is determined by the efficiency in the viability and scalability of the vendor. If the organisation received an experienced vendor who has the capability of making the system ready to adopt changes happening in the future will contribute more to enhance the strategic outcomes of the organisation. The PLS SEM is denoting that there is a significant impact of the efficiency of the vendor to make the organisation capable of adopting strategies for business growth (*B =0*.486, *t=10.785, p = 0*.000). The mean rank revealed that if the organisation adopts a highly viable and scalable vendor, it contributes more to the success of the organisation by adopting strategies to survive in the business. The contribution to strategic impact is decreasing as the viability and scalability of the vendor decreases.

16. The organisational readiness was measured using the factors such as resource mobilisation, BPR and end-user training. The study found that these three CSFs made a significant difference in the strategic impact of ERP implementation as $p<0.05$. From the mean rank the study identified that higher efficiency in resource mobilisation and end-user training made high differences in the strategic benefits of the organisation followed by average and lower efficiency respectively. The average efficiency in BPR made a high difference in the strategic benefits more than high and low BPR efficiency.

17. Data migration efficiency, system testing efficiency and system upgradation efficiency are the three factors used to measure the impact of information system readiness on the strategic benefits of the organisation. The test result identified that there is a significant difference in strategic benefits of ERP implementation with the difference in the efficiency in system testing and system upgradation as $p<0.05$. The difference in the mean rank strengthens the above result. The mean rank is indicating that the strategic impact is very low at lower efficiency in system testing and system up gradation.

18. The study found that the CSFs, functional scope, physical scope, vendor and consultant's scalability and viability, ERP vendor. Customisation level, consultancy services, implementation approaches, resource mobilisation and data migration made differences in the strategic impact of ERP but it was not statistically significant.

8.3.b Findings Summary: ERP implementation-CSFs on organisational capability and its Components

Table 8.3

Findings Summary: Impact- CSFs on Organisational Capability and its Components

CSFs	OGCB	Components of OGCB				
		INLO	OTLO	OPXL	DNMK	STIM
FNP						
PHS						
VDV		*				
VDS	*	*		*	*	
CTV						
CTS	*	*		*	*	
EPV						
CTL	*			*		
CNTS						
IMPA						
RMO	*	*		*	*	*
BPR	*			*		*
EUT						*
DMG				*		
STG				*		*
STU	*			*		*
R^2	0.906	0.941	0.952	0.856	0.831	0.884

Note: * denotes those impact variables which made a statistically significant difference with the difference in the CSFs.

The table 8.3 above presents the CSFs selected for the study and the impact variables.

The study found that the difference in the resource mobilisation efficiency made more difference in the impact variables than any other CSFs. The overall organisational capability and its four components, inbound logistics capability, operational excellence, strategic impact and decision-making capability were significantly varied as per the difference in the resource mobilisation efficiency of different enterprises.

The scalability of vendor and consultant stands next to resource mobilisation efficiency, which made significant differences in the overall organisational capability and three other impact variables, which include inbound logistics, operational excellence and decision-making capability.

BPR and system upgradation made significant difference in two impact variables, operational excellence and strategic impact and it also made variations in the overall organisational capability.

The difference in the customisation level made a significant change in the operational excellence and also in the overall organisational capability.

Even the difference in the system testing efficiency made a significant difference in two impact variables: operational excellence and strategic impact. It did not make any significant difference in the overall organisational capability.

The CSFs, end-user training impacted the strategic benefits of ERP, data migration impacted the operational excellence and vendor viability on inbound logistics Capability. Thus, all the three factors made a significant difference only in one impact variable and none of them made any significant difference in the overall organisational Capability.

Regarding the other six CSFs, functional scope, physical scope, consultant viability, ERP vendor, consultancy services and implementation approaches did not make any differences in the overall organisational capability and even in any components of the organisational capability .

As per the number of impact variables, the study listed and ranked the CSFs in the table 8.4.

Table 8.4

Rank: CSFs based on impacted variables

Rank	CSFs	Impacted Variables
I	Resource Mobilisation	a. Organisational Capability b. Inbound Logistics c. Operational Excellence d. Strategic Impact and e. Decision-Making.
II	Vendor Scalability and Consultant Scalability	a. Organisational Capability b. Inbound Logistics c. Operational Excellence and d. Decision-Making.
III	BPR and System Upgradation	a. Organisational Capability b. Operational Excellence and c. Strategic Impact.
IV	Customisation Level	a. Organisational Capability and b. Operational Excellence
V	System Testing	a. Operational Excellence and b. Strategic Impact.
VI	End-User Training Data Migration Vendor Viability	a. Operational Excellence b. Inbound Logistics c. Strategic Impact.

Note: The customisation level and the system testing Efficiency made significant difference in two impact variables, but the study ranked customisation level above the CSF because it made a significant difference in the overall organisational capability which the system testing did not make.

8.3.4 Objective 3 – To Identify the Impact of CSFs on the Financial Performance of the Organisations

The study made an attempt to identify, whether the CSFs made any impact on the financial performance of the company. As the regression analysis can do only on categorical data, the study removed ten CSFs and included the remaining six CSFs to test its impact on the financial performance. Those CSFs are functional scope, physical scope and software readiness: ERP package vendor, customisation level, consultancy services and implementation approaches. The impact was identified by analysing the impact of the selected CSFs on ROA, ROS, SG&A, CGS, ATR, DTR, ITR and FAT. The study analysed the financial performance during the 5 years post ERP implementation and 10 years post ERP implementation. It was found that to identify the real impact of ERP it is better to take at least three years post implementation period's financial data because the immediate post implementation period will not give the exact result. After analysing the 5 years data, the study analysed the impact of CSFs after 10 years of ERP implementation and compared the result of the two periods to identify the consistency of performance. Finally, the study found that,

19. Impact of CSF on ROA

After analysing the post five years data the study identified that consultancy services ($B = 0.125$, $t=3.635$, $p = 0.000$) and customisation level ($B = -0.062$, $t=-2.284$, $p = 0.023$) showed a statistically significant impact on the ROA of an organisation. It can be concluded that the service of the consultant makes the working of the ERP system to manage the assets of the company for its efficient utilisation. Hence, as to generate higher return on assets. The company, which opts the service of the consultant enhanced their ROA in comparison with that of the companies which did not use it. As the beta coefficient is negative, it can be concluded that, when the customisation level increases it reduces the ROA. The adjusted R^2 is indicating that 51.68% of the variations in the ROA of the selected organisation is caused by the CSFs-functional scope, physical scope, ERP package vendor, consultancy services, customisation level and implementation approaches.

The study analysed the impact of the selected CSFs on the ROA of the organisations in the post 10 years of ERP implementation. The study identified that even though the CSFs made impacts on the ROA, it is not statistically significant as none of their p value is less than 0.05. But it is found that 48.97% of the variations in ROA are due to the CSFs identified.

Thus, it can be concluded that consultancy services and customisation level showed a statistically significant impact on the ROA in the post 5 years of implementation, but it became statistically insignificant in the post 10 years and none of the CSFs showed a significant impact in the post 10 years of implementation. While comparing the R^2, it decreased by 2.72% from the post 5years of ERP implementation.

20. The impact of CSFs on ROS

After analysing the post five years data the study identified that consultancy services *(B =0.*129*, t=2.740, p = 0.*0414) and customisation level *(B =-0.*129*, - t=-2.031, p = 0.*0423) showed a statistically significant impact on the ROS of an organisations. It can be concluded that the service of the consultant makes the company to turn its sales to profit efficiently, more than the companies which did not adopt consultancy services. The *B* value is showing a negative impact, i.e., as the customisation level increases the ROS decreases. The adjusted R^2 is indicating that 21.53% of the variations in the ROS of the selected organisations is caused by the CSFs-functional scope, physical scope, ERP package vendor, consultancy services, customisation level and implementation approaches.

The study again analysed the impact of the selected CSFs on the ROS of the organisations in the post 10 years of ERP implementation. It was found that among the CSFs that had impact on the ROS, only consultancy services were statistically significant *(B =0.*1097*, t=2.060, p = 0.*0479). It was also found that 20.45% of the variance in ROS were due to the CSFs identified.

Thus, it can be concluded that consultancy services and customisation level showed a statistically significant impact on the ROS in the post 5 years of implementation, but only consultancy services made a statistically significant impact in the post 10 years. While comparing the R^2, it decreased by 1.08% from the past 5years of ERP implementation.

21. Impact of CSF on SG&A

After analysing the post five years data the study identified that Functional Scope *(B =-0.*576*, t=-8.807, p = 0.*000), physical scope *(B =-0.*138*, t=-3.382, p = 0.*001), consultancy services *(B =-0.*142*, t=-3.852, p = 0.*001) and customisation level *(B =-0.*153*, t=-5.055, p = 0.*000) are indicating statistically significant impact on the

SG&A of an organisation. It can be concluded from the *B* value that, when the ERP implemented has a larger functional scope, the SG&A of an organisation declines. Not only functional scope, the result of the impact of physical scope, consultancy services and customisation level is also revealing a negative impact i.e. When the physical scope, consultancy services and customisation level is large, the SG&A shows a declining trend. The adjusted R^2 is indicating that 65.23% of the variations in the SG&A of the selected organisations is caused by the CSFs-functional scope, physical scope, ERP package vendor, consultancy services, customisation level and implementation approaches.

The study again analysed the impact of the selected CSFs on the SG&A of the organisations in the post 10 years of ERP implementation. The study identified that among the CSFs that had impact on the ROS, only Functional Scope is statistically significant ($B = -0.024$, $t = -2.577$, $p = 0.005$). It is found that 43.59% of the variance in SG&A were due to the identified CSFs.

Thus, it can be concluded that Functional Scope, physical scope, consultancy services and customisation level showed a statistically significant impact on the SG&A in the post 5 years of implementation; but only Functional Scope had statistically significant impact in the post 10 years. While comparing the R^2, it decreased by 21.63% from the past 5 years of ERP implementation.

22. Impact of CSF on CGS

After analysing the post five years data the study identified that functional scope ($B = -0.297$, $t = -9.109$, $p = 0.000$), physical scope ($B = -0.173$, $t = -4.095$, $p = 0.000$), consultancy services ($B = -0.152$, $t = -3.895$, $p = 0.000$) and customisation level ($B = -0.164$, $t = -5.039$, $p = 0.000$) are indicating a statistically significant impact on the CGS of an organisation. It can be concluded from the *B* value that, when the ERP implementation has a larger Functional Scope, the CGS of an organisation decline. Not only functional scope, the result of the impact of physical scope, consultancy services and customisation level are also revealing a negative impact i.e., when the physical scope and customisation level is large and adoption of consultancy services, the CGS shows a declining trend. The adjusted R^2 is indicating that 55.24% of the variations in the CGS of the selected organisations is caused by the CSFs-Functional Scope, physical scope, ERP Package Vendor, Consultancy Services, customisation level and implementation approaches.

The study again analysed the impact of the selected CSFs on the CGS of the organisations in the post 10 years of ERP implementation. It was found that among the CSFs that had impact on the CGS, only functional scope is statistically significant ($B = -0.051$, $t = -3.313$, $p = 0.0196$). It is also found that 49.14% of the variations in CGS are due to the identified CSFs.

Thus, it can be concluded that Functional Scope, physical scope, consultancy services and customisation level showed a statistically significant impact on the CGS in the post 5 years of implementation, but only Functional Scope is showing a statistically significant impact in the post 10 years. While comparing the R^2, it decreased only by 6.09% from the past 5years of ERP implementation.

23. Impact of CSF on ATR

After analysing the post five years data the study identified that physical scope ($B = 0.066$, $t = 2.618$, $p = 0.039$), and customisation level ($B = -0.117$, $t = -3.598$, $p = 0.000$) are indicating a statistically significant impact on the ATR of the organisations. It can be concluded from the *B* value that, when the ERP implemented has a larger physical scope the ATR of an organisation increases. But in the case of customisation level, the B value is showing a negative impact, it means that, as the customisation level increases the ATR decreases. The adjusted R^2 is indicating that only 7.33% of the variance in the ATR of the selected organisations is caused by the CSFs-functional scope, physical scope, ERP package vendor, consultancy services, customisation level and implementation approaches.

The study again analysed the impact of the selected CSFs on the ATR of the organisations in the post 10 years of ERP implementation. It found that even among the CSFs that made impact on the ATR, only physical scope is statistically significant ($B = 0.063$, $t = 2.468$, $p = 0.014$). It is also found that 6.94% of the variations in ROS are due to the CSFs identified.

Thus, it can be concluded that physical scope and customisation level show a statistically significant impact on the ROS in the post 5 years of implementation, but only physical scope is showing a statistically significant impact in the post 10 years. While comparing the R^2, it decreased by 1.22% from the past 5years of ERP implementation.

24. Impact of CSF on DTR

After analysing the post five years data the study identified that functional scope *(B* =2.517736*, t*=4.227612*, p* = *0*.000) and physical scope *(B* =1.601004*, t*=2.375192*, p 0*.0176) are indicating a statistically significant impact on the DTR of the organisations. It can be concluded from the b value that, when the ERP implemented has a larger Functional Scope the physical scope the DTR of an organisation increase.

The adjusted R^2 is indicating that 9.98% of the variations in the DTR of the selected organisation is caused by the CSFs-functional scope, physical scope, ERP package vendor, consultancy services, customisation level and IMPV.

The study again analysed the impact of the selected CSFs on the DTR of the organisations in the post 10 years of ERP implementation. It found that even among the CSFs that made impacts on the DTR, only functional scope *(B* =0.542783*, t*=4.180257*, p* =0.0000) is statistically significant. It is also found that 7.11% of the variations in DTR are due to the identified CSFs

Thus, it can be concluded that functional scope and physical scope show a statistically significant impact on the DTR in the post 5 years of implementation, but only functional scope is showing a statistically significant impact in the post 10 years. While comparing the R^2, it decreased by 2.13% from the past 5years of ERP implementation.

25. Impact of CSF on ITR

After analysing the post five years data, the study identified that functional scope *(B =0*.394*, t=2.906, p = 0*.005), physical scope *(B =0.153, t=2.922, p = 0*.020), consultancy services *(B =0.077, t=4.010, p = 0.*000) and customisation level *(B =-0.*100*, t=-2.947, p = 0.*003) are indicating a statistically significant impact on the ITR of an organisation. It can be concluded from the *B* value that, when the ERP implementation has a larger functional scope the ITR of an organisation increases. Not only functional scope, the result of the impact of physical scope and consultancy services is also revealing a positive impact, i.e. When the functional scope and physical scope is large and when consultancy services are adopted, the ITR shows an increasing trend except customisation level. The adjusted R^2 is indicating that 48.3% of the variations in the ITR of the selected organisations is caused by the CSFs-functional scope, physical scope, ERP Package Vendor, Consultancy Services, customisation level and implementation approaches.

The study again analysed the impact of the selected CSFs on the ITR of the organisations in the post 10 years of ERP implementation. It was found that among the CSFs that had impact on the ITR, only functional scope *(B =0.262, t=2.100, p = 0.*0497) and physical scope *(B =0.163, t=2.189, p = 0.*029) are statistically significant. It is also found that 39.99% of the variance in ITR are due to the identified CSFs

Thus, it can be concluded that functional scope, physical scope, consultancy services and customisation level showed a statistically significant impact on the CGS in the post 5 years of implementation, but only functional scope and physical scope is showing a statistically significant impact in the post 10 years. While comparing the R^2, it decreased by 8.64% from the past 5years of ERP implementation.

26. Impact of CSF on FAT

After analysing the post five years data the study identified that functional scope *(B* =1.201496*, t*=3.012625*, p* = 0.0026**)** and physical scope *(B* =1.469429*, t*=2.195882*, p* = 0.0282**)** are indicating a statistically significant impact on the FAT of an organisation. It can be concluded that from the *B* value that, when the ERP implementation has a larger Functional Scope and physical scope the DTR of an organisation increase. The adjusted R^2 is indicating that 9.14% of the variations in the FAT of the selected organisations is caused by the CSFs-functional scope, physical scope, ERP package vendor, consultancy services, customisation level and implementation approaches

The study again analysed the impact of the selected CSFs on the FAT of the organisations in the post 10 years of ERP implementation. It was found that among the CSFs that had impact on the FAT, only physical scope *(B* =1.520939*, t*=2.087969*, p* =0.0488**)** is statistically significant. It also found that 7.08% of the variations in DTR were due to the identified CSFs

Thus, it can be concluded that functional scope and physical scope showed a statistically significant impact on the DTR in the post 5 years of implementation, but only physical scope is showing a statistically significant impact in the post 10 years. While comparing the $R^{2,}$ it decreased only by 2.06% from the past 5years of ERP implementation.

8.3.c Findings Summary: ERP implementation-CSFs on the financial performance

Table 8.5

Findings Summary: Impact- CSFs on Financial Performance

CSFs	Financial Performance															
	ROA		ROS		SG&A		CGS		ATR		DTR		ITR		FAT	
	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years
FNP					*	*	*	*			*	*	*	*	*	
PHS					*		*		*	*	*		*	*	*	*
EPV																
CNTS	*		*	*	*		*						*			
CTL	*		*		*		*		*				*			
IMPA																
R^2	0.523	0.490	0.230	0.217	0.674	0.456	0.565	0.507	9.028	4.241	9.983	7.855	52.201	41.901	8.844	8.703

Note: * The CSFs, which made a significant difference in the financial performance

The above table 8.5, shows the summary of the research findings on the impact of financial performance due to the CSFs in the process of ERP implementation.

Functional scope, physical scope, consultancy services and customisation level are the four CSFs which influenced the financial performance in the process of ERP implementation. The difference in ERP vendor and the variations in implementation approaches made changes in the financial performance but not significant.

SECTION C

8.4 Discussion

The purpose of this study is to gain a better understanding of how organisations implement ERP systems and to determine if the Critical Success Factors associated with each stage of the ERP implementation process have any impact on the organization's capability and, ultimately, its financial performance. In addition, the study aimed to determine the variance in the time and cost of ERP implementation as a result of the Critical Success Factors adopted by various organisations during ERP implementation.

The result indicates that both the capability of the organisation and its financial performance have changed due to the critical success factors in the process of ERP implementation. To identify the financial performance, the study selected ROA, ROS, SG&A, CGS, ATR, DTR, ITR and FAT. It was found that functional scope, physical scope, consultancy services, customisation level showed a significant impact on the financial performance of the organisation. Only consultancy services on ROS, functional scope on SG&A, CGS, DTR and ITR, physical scope on ATR, ITR and FAT, consultancy services on ROS showed a significant impact in both post 5 years and post 10 years of ERP implementation. A study conducted by Ash and Burn (2003) came to a conclusion that there is a retirement of the implemented ERP system probably after five or ten years of ERP implementation. The present study came to the same conclusion after seeing the declining trend of the performance. Thus, the comparison of the performance of the post ten years of ERP implementation to the performance of the post five years (immediate years after implementation) of ERP implementation, the study found that, as years passed the performance is showing a declining trend.

The regression result of the present study was pointed that ERP implementation helps to reduce the COGS and SG&A of the organisation which is consistent with the outcome of the study done by Ali (2016), while taking the same sample period (post 10 years of ERP implementation)

The study of Galy and Sauceda (2014) equates the present study as the study is showing a positive impact of ERP implementation on ROA and ROS even it decreases after the immediate five years of ERP implementation. The study of Hitt et al., (2002) analysed and identified the same result of the study of Galy and Sauceda (2014) i.e. The performance of ERP adopters is greater when it is compared to the ROA. The outcome of the study of Galy and Sauceda (2014) is similar to the outcome of present study not only when compared to ROA, the result is same in terms of ITR, DTR. Hence, like the study of Galy and Sauceda (2014) the present study also identified a positive impact of ERP implementation on ROA, ITO and DTR.

From the present study, it was found that the adoption of consultant made differences in the capability of the organisation, but it was not statistically significant. But their efficiency made a significant impact on the ROA, ROS, SG&A, CGS and ITR especially in the post five years of ERP implementation. The study of Madapusi (2008), got a different result and it indicated that the consultants mostly exert a negative impact on the ERP implementation process. This could be brought on by the paucity of consultants who have the necessary inter-personal, technical, business, and product abilities to direct the implementation process. The results show that rather than outsourcing their skills the businesses might spend money on internally developing consultants. Hence, the study concluded that the adoption of the consultant is a costly affair and it benefitted the organisation mostly in the post 5 years of ERP implementation, then it declined.

The present study identified the decline in the performance of the organisation was due to the inefficiency in the selected CSFs in the ERP implementation process

This inefficiency of the organisation had slowed down the inbound logistic operational capability, operational excellence. the decision-making capability, the strategic benefits of the ERP system and also the overall organisational capability.

The inefficiency of the organisation in adopting those vendors whom are efficient in the scalability of the ERP system and whom are viable, the inefficiency in selecting the consultant whom are efficient in the scalability of the ERP system and the inefficiency of the organisation in mobilising resources for the proper implementation of ERP system decreased the inbound logistics capability of the organisation. Thus, the study identified that the overall inefficiency in consultant evaluation, organisational readiness and information system readiness decreased the inbound logistics capability of the organisation.

The operational excellence of the selected organisations was declined due to the inefficiency of the organisation in evaluating the scalability of the vendor and the consultant, in mobilising resources, in selecting the appropriate customisation level, in reengineering business process, in data migration, in system testing and the inefficiency in system upgradation. The overall inefficiency in the organisational readiness decreased the operational excellence of the organisations.

The study identified that the ERP implementation made differences in the decision-making capability of the organisation. But the inefficiency of the organisation in evaluating the scalability of the vendor and the consultant and the inefficiency in mobilising resources showed a declining trend in the decision-making capability of the organisation comparing to those organisations whom were efficient in that. Like operational excellence, the overall inefficiency in organisational readiness in implementing the ERP system lessens the decision-making capability.

The organisations which were inefficient in mobilising enough resources, in reengineering the existing business processes, inefficient in providing training to the end users and inefficient in testing the new ERP system and its upgradation showed a drop in the strategic benefits experienced by the organisation after ERP implementation. The organisations which showed efficiency in managing the CSFs received more strategic benefits than those which are inefficient. The present study came to a conclusion that the differences in certain CSFs selected for the study made a significant difference in their strategic impact. These CSFs are the resource mobilisation, BPR, end-user training, system testing and system upgradation. The study of Dantes and Hasibuan (2011) is similar to the present study regarding the strategic benefits of ERP implementation. The exploratory study of Ranjan et al., (2017) identified and listed the strategic benefits from the implementation of ERP in the Indian manufacturing enterprises which were efficient for the successful implementation of ERP system. The theory of Ranjan et al., (2017), comes to a conclusion that the ERP implementation has a more significant tactical impact rather than strategical impact.

Finally, the study analysed the reasons for the reduction in the overall capability of the organisation and it was found that the inefficiency of the organisation in evaluating the scalability of the vendor and the consultant, inefficiency in mobilising resources and reengineering business process and the inefficiency in system upgradation gave way for the significant reduction in the overall organisational capability. The overall incapability of the organisation in evaluating the consultant and making the organisation ready for ERP implementation also gave way to the organisational capability decline.

The study of Velcu (2007) comes with the theory that, when users became familiar with the software functionalities through suitable training programs, the benefits generated by the ERP system enhanced. The present study supports the theory of Velcu (2007) because the efficiency in training programs made a significant difference in the strategic benefits from the ERP system while comparing to the organisations which were inefficient in that...

Nah and Lau (2001), explained that BPR, minimum customization and efficient system testing enable the business organizations to enhance the ERP system performance to grab maximum benefits from ERP. The present study supports the study of Nah and Lau (2001) regarding the three identified CSFs i.e, BPR, customisation level and system testing. The study also got a similar result like the study of Tsai et al., (2010) on the positive impact of BPR in process of ERP implementation. The present study supports the study of both Nah and Lau (2001) and Tsai et al., (2010) as the study identified the efficiency in BPR made a significant change in the Strategic impact of the organization, operational excellence and finally it enhanced the overall organisational capability.

SECTION D

8.5 Conclusion

Organisations are making use of many Management Information Systems for efficient and effective use of the business data. Enterprise Resource Planning system is considered as a big part of the Management Information System. The ERP system is at the forefront to integrate the business information across all functions and operations of the business. The implementation of this ERP system has been not just an installation of a simple software package. It takes months and often years for the planning and implementation of this sophisticated technology. The business needs to invest their time, money and efforts to make the ERP implementation project to become successful. Even though the business firms invest theses valuable resources for getting the best results from the ERP investment, it may not happen always. Many organisations faced failures at the time of implementation and even after the implementation and sometimes several years later.

This study thus made an attempt to investigate into the process adopted by different organisations to implement ERP system and the critical factors in the ERP roll out. After finding the CSFs in the process of ERP implementation, the study analysed its impact on the organisational capability and financial performance of the large and medium manufacturing enterprises of the India's top three industrial states; Maharashtra, Tamil Nadu and Gujarat. The study identified many factors, which are very critical for the ERP implementation and focused on sixteen factors which are critical for the success of ERP implementation. For better planning of an ERP project, the study gives insight into the CSFs which affect the project implementation time and project implementation cost. The prime objective of the study was to provide valuable suggestions to the organisation who are planning for ERP implementation and for the organisation which are facing issues from the implemented ERP system and those organisations which faced failure in the ERP implementation. Hence, to provide some more light into that the study analysed the impact of these CSFs on the capability of the organisation and the impact of these CSFs on the various components that lead to organisational capability. To increase the study's credibility, it also considers the impact of the selected CSFs on the financial performance of the organisation.

The study found that the identified CSFs, particularly efficient vendor and consultant, efficiency in preparing the organisation for proper ERP implementation, and Optimal Customisation level in the process of ERP implementation had a major role in enhancing the organization's capability. During the ERP implementation process, the consulting services, optimal customisation level, optimal functional scope, and optimal physical scope of the project contributed to a better financial performance.

Thus, the study found that the capability of the organisation was increased after ERP implementation and its financial performance was also increased in the immediate years of ERP implementation and then showed a slower pace of decline thereafter. The declining trend of the organisation's performance was found to be the impact of inefficiency in some of the CSFs like selection of the vendor and consultant, mobilisation of resources, BPR, level of customisation, migrating data to the new ERP system, ERP system testing, providing training to the end users and also inefficiency in upgrading the implemented ERP system. Some of the organisations implemented the ERP system with the support of consultants, but some others did it without consultants. This adoption and non-adoption of consultants also made an impact on the performance of the organisation. These findings guide the study to suggest certain valuable measures to enhance the organisational capability and performance, which are given in the following chapter.

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Chapter Nine

RECOMMENDATIONS, IMPLICATIONS AND SCOPE FOR FURTHER RESEARCH

9.1 Introduction

This chapter presents recommendations from the study, the implications of the recommendations put for by the present study and the suggestions of some research topics for further research in this area.

9.2 Recommendations to the organisations

1. According to the findings of the study, if companies opt for a higher level of customization, the ERP implementation outcome will not differ significantly. The organisational capability of those organisations which opted a minor ERP customisation was much higher than those organisations opted zero, moderate and major levels of customisation. In addition to organisational capability, the capability of inbound logistics, operational excellence, decision-making ability, and the strategic impact of ERP, demonstrated to be less capable at the extreme customisation level. The majority of the organizations, however, showed a greater capability at 1-10% level of customisation (minor customisation) and 11-25% level of customisation (moderate customisation). As the level of customization increases, so does the project cost. Comparing project cost and benefits, the study is recommending **minor level of customization, between 1 and 10 percent, is the optimal choice.**

2. The CSFs, vendors and consultant scalability, system upgradation and the end user training is a continuous task of the organisation, and it should be efficiently managed to ensure consistency in the organization's capabilities. The organisations whose system upgrades and end-user training programmes were ineffective, as well as those who adopted a vendor and consultant with inadequate ERP system scalability, exhibited a declining trend in organisational capability. The organisations which are highly efficient in these

CSFs had improved the business capability. Hence, the study is recommending the organisations to adopt the following measures:

A. Ensure the scalability of the vendor and the consultant for the continued existence of the current ERP system in order to operate in accordance with the company's expanding needs. The study found that organisations that adopted consultants and vendors with poor scalability exhibited poor inbound logistics capability, operational excellence, and decision-making capability, which ultimately diminished their overall organisational capability. Hence, effective ERP implementation **requires consultants and vendors, who have high potential in scalability.**

B. The organisation with poor efficiency in system upgradation reflects a lesser organisational capability, operational excellence and poor strategic impact. This makes way to the retirement of the existing ERP system and enhance the financial burden of the organisation by implementing new ERP system. Hence, it is essential to **upgrade the existing ERP system** to become competitive. The organisation can make use of the service of the vendors and consultants and also the support of key IT experts to ensure that the system is upgraded properly or not and to make system upgradation takes place more efficiently.

C. The ERP implementation results in a radical organisational transformation. It may cause confusion and conflict among employees, and it is essential that they adopt to the new business practises. Continues and specialised training is an inevitable part of an effective ERP implementation process. From the study, it was found that that the strategic impact of ERP implementation was declined due to the lack of efficiency in providing training to the end users of ERP. Hence, to enhance the efficiency, it is recommended to provide a **continuous specialised training program,** considering the requirements and weakness of end users and also to **provide cross functional training programs** to them.

3. The study revealed that differences in the ERP modules implemented did not have a significant impact on the organization's capability, but did have a

significant positive correlation with its financial performance. From the financial performance it is determined that organisations that simultaneously implemented ERP system across all organisational functions had better financial performance. For other organisations which adopted module wise and ERP role out for implementation did not make a significant improvement in the financial performance. Hence, the study recommends the organisation to adopt the **big bang approach** of ERP implementation. But the study is also suggesting an **efficient project team** comprised of both **experienced vendor and consultant** along with **representatives from the key departments** of the organisation and **persons from other organisations** who were a part of successful ERP implementation teams in their respective organisation, to conduct a detailed study on the functional requirements of the organisation to decide which module the organisation needs to invest to fulfil the functional requirements.

4. It is preferable to **appoint a monitoring team** with two or three members with expertise in both the ERP system and the organization's operations, who monitor the working of ERP system in every branch and every function of the organisation. Additionally, the organisation can consider appointing one or two key personnel and an ERP consultant to that monitoring team.

5. Every project will become successful only if there are optimum resources to accomplish the project otherwise it will end in chaos. The study identified that the capability of the organisation showed a declining trend due to the inefficiency in mobilising enough resources in implementing and upgrading the ERP system. Hence, the study recommends the organisations **to make a deep and elaborate study on the** existing resources in the organisation, plan and accumulate additional resources if required and more than that they should ensure the availability of resources at the required time, then only they need to initiate the actual ERP implementation. Because efficient resource mobilisation is the backbone of successful ERP implementation

6. It was found that the organisations which were inefficient in BPR demonstrated a lack of operational excellence and a lack of ERP's strategic impact, which ultimately reduces the capability of the organisation. Hence, the study recommends the organisations, to work on the **business reengineering activities** for an effective ERP implementation. This can be done by analysing the existing business process for identifying the business process that requires changes and to design a new business process as per the ERP requirements. The essential part of successful implementation of ERP is the successful integration of the reengineered business process with the ERP system. Not only that, it requires continuous monitoring to check whether the reengineered business process is successful in adopting the new ERP system.

7. Every project will become successful only if it has been completed in a short duration efficiently. From the study, none of the CSFs impacts the project time except the implementation approaches. The study suggests to opt big bang approach for ERP implementation because it takes lesser time. In addition, the study also found that the difference in the implementation approach did not make any difference in the project cost. Therefore, it is **preferable to go for the big bang approach**. Business resources are a valuable part of the organisation. If the organisation takes too much time in implementing the ERP system, they need to engage the most valuable and irreversible organisational resources in an inefficient way. This may create opportunity cost. Hence, the organisation should take at most care in reducing or finding an optimum implementation duration. Because longer it takes worse will be the result. Hence, by adopting big bang approach, the organisation can reduce the project time and thereby project cost.

8. The selection of ERP vendor did not make any variations in performance, but the cost of the package will add to the project cost. Hence, the study recommends to **adopt most suitable package from the most economical vendor without considering the market leadership.**

9. The company must maintain a **proper and continuous communication with the ERP vendor and the consultant** to discuss the issues in the business operations, the present situation and requirements of the business, their future needs etc... Efficient and effective communication is the only way to avoid confusions and misunderstanding and other issues between vendor and consultant and the organisation. Even the vendors and consultants provide demo sessions of the new project, in most of the cases the project manager or IT manager will participate. Hence, it may be more effective if there is participation of the functional heads of the organisation to provide more suggestions based on their requirements.

9.3 Implications of the Study

1. Most organisations preferred zero customisation by depending mostly on minimum basic configuration and making minor changes in the source code of the software system because of the fear of customisation. Customisation is a costly affair and even breaks the budget of ERP implementation. The common behaviour of reluctancy to accept change and too much confidence in the reputation of the vendor make the organisation to step back from customisation. But the study suggested the organisations to go for minor level of customisation. The minor level of customisation helps the organisation in maintaining the ERP implementation cost at a moderate level and within budget. Minor customisation also helps to avoid complexity in the up gradation of ERP system. It is observed that business organisation should upgrade their ERP system at least once in every two or three years. If there is over customisation, the upgradation also takes too much time and cost. If the organisation needs to switch the ERP vendor or the ERP consultant, it is better to avoid over customisation so it will reduce the complexity of switching. Now a days most of the efficient ERP vendors are providing tailor made ERP software packages as per the business requirements. Hence, it is beneficial to go for minimum or minor level of customisation.

2. The study recommends consultants and vendors who have high scalability efficiency. Thereby the organisations can manage additional ERP users in the future, the expansion of the business's functionalities, and the expansion of the business in accordance with market requirements and thereby improving their performance.

3. The efficient upgradation of the ERP system, without making any interruption in the business operations helps to provide additional features and thereby magnify the mechanism of the employed ERP system. The better performance of the system strengthens the capability and performance of the organisation. In addition, it assists the organisation in comprehending and fulfilling the prevailing market requirements, as well as in anticipating future market demands. Upgradation of the system aids the organisation in maintaining overall business quality and consistent performance.

4. Continuous training programs helps employees to understand the changes happening in the ERP technology and the changes happening in the business operations resulting from ERP system changes. Cross functional training programs helps the end users in knowing, how the information integration among different departments is happening, and it reduces confusions and conflicts in fulfilling business requirements and also facilitating the assignment of responsibilities and to know who reports to whom. It also helps in employee collaboration and performance consistency. The technological training program is a costly affair of the business, but if organisation made any lapse in its implementation, the business's performance may suffer.

5. By adopting a big bang approach rather than module wise or roll out approach, the organisation is required to spend its time, cost and effort only at a single time in its entire existence. Otherwise, they need to take the same process and risk while implementing each module or a couple of modules in different intervals and also while implementing ERP in each unit or couple of units separately in different intervals. In all other approaches, the organisation needs to manage its legacy system in parallel to the ERP system. It creates

confusion and imposes the limitation of lacking a single database. The integration of the entire organisation and its units is not possible without big bang approach. Besides that, by adopting the other ERP implementation approaches rather than a big bang approach, the organisations take more time for ERP implementation. Therefore, it ultimately affects the ERP implementation cost.

10. After immediate years of ERP implementation, the organisation's performance began to decline. Hence, by appointing a monitoring team the organisation can observe the working of each branch and functions under ERP system and can easily check the differences in the capability and performance of each branch in each interval and should identify those branches and functions which perform efficiently and which are not, even after the ERP implementation. The organisation should verify the team's reports at regular intervals to determine if they are capable of performing the assigned tasks. Then only the organisation can identify the ERP issues associated with each branch and functions of the organisation i.e., to identify issues like information integration issues, security issues, information hacking issues, information duplication, etc. and also it helps to understand, the need of system upgradation, identification of required training programs to the end users, the need of BPR, need of additional resources, if any, implication of new ERP module and the need of switching of an ERP vendor and consultant or their retention.

11. ERP implementation requires large investment and other resources. The ineffective mobilisation of required resources hinders the ERP implementation process and the essential ERP system upgradation. If the organisation is efficient enough to manage enough resources for the ERP implementation, it will help them to acquire the software system from the selected vendor itself, with required functions, features, scalability and customisation. It helps to provide efficient training to the end users of ERP. It supports the organisation in implementing the ERP system with the support of ERP consultant. By

mobilising the required resources, the organisation can do the business reengineering process, the data migration process and system testing process more efficient.

12. From the study, it was found that there is no significant difference in the capability and performance of the organisation, if the organisation adopts the market leader or any other ERP vendors. It also found that, the adoption of the market leaders in the ERP software market makes the implementation cost much higher. Hence, by adopting the package from the most viable ERP vendors rather than the market leaders, the organisation can reduce the entire ERP project Cost to some extent.

13. The effectiveness of BPR to pave the way for a successful ERP implementation is an indispensable aspect of ERP implementation. The traditional business operations involve too much complicated and complex process. By implementing ERP, the complexity and complications in business operations will reduce. Hence, the organisation needs to integrate different processes or operations of the system, need to eliminate some process or operations. This may require a role change of the employees after ERP implementation. The efficiency in BPR take care of all those requirements for converting the legacy system into new integrated centralised ERP system. However, businesses must ensure that BPR is not more complex and expensive than ERP implementation. Otherwise, the companies need to spend their time, cost and efforts in BPR more than ERP implementation, which ultimately leads to budget overrun and sometimes the stoppage of ERP implementation.

9.4 Scope for further Research

From the very beginning of the research work and up to the completion of writing the thesis, the researcher went through numerous scholarly works, made detailed discussions with various subject experts and conducted surveys to find the impact of ERP implementation. The knowledge gained from these research activities helped the researcher in identifying further issues pertaining to ERP implementation.

Thus, the study suggests a few research topics on ERP implementation for further research. They are:

1. The present study focused on the manufacturing sector as a whole. But further research can be carried out by focusing on any particular industry under manufacturing sector with enough samples from that particular industry.

2. Further studies can be carried out on the impact of ERP implementation in sectors other than manufacturing sector as the present study limits its reach to understand the process and impact of ERP implementation only in the manufacturing enterprises in India.

3. The present study utilised the data of the enterprises located in Maharashtra, Tamil Nadu and Gujarat. There is enough scope for further research by taking samples from more industrial states in India to get more reliable outcome.

4. The study suggests an analysis on the process and impact of implementing cloud ERP system in manufacturing enterprises and also recommends a comparative study on enterprises using cloud ERP and the traditional ERP system.

5. A detailed study on the process and impact of implementing ERP system in the small-scale manufacturing sector is a very relevant one while considering the Indian industrial sector with well-established small-scale industries.

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APPENDICES

Appendix I

QUESTIONNAIRE: ERP/IT HEAD

I am Shija T (Research scholar, Department of Commerce and Management Studies, University of Calicut, Kerala), conducting this study as part of my research work. I am inviting you to respond to the questions based on your ERP knowledge and experience in this firm. I am ensuring you that the responses will only be aggregated to the other responses from different manufacturing enterprises across India and only use for statistical analysis in the current PhD study. Any information contained in your response will be treated with strict confidentiality and in an ethical manner. I appreciate your time and effort.

Please read the statements and fill the appropriate boxes

- Please check and select your ERP Vendor/s (Please give tick marks)

  ( ) SAP

  ( ) Oracle People soft

  ( ) Microsoft Dynamics

  ( ) Ramco

  ( ) Others (Specify)……………………………………………………………

- Please mention the ERP modules implemented by your organisation (Please give tick marks)

  ( ) Accounting and Finance

  ( ) Work Force Management

  ( ) Human Resource Management

  ( ) Procurement/Purchasing

  ( ) Manufacturing

  ( ) Inventory Management

  ( ) Ware House Management

  ( ) Order Management

  ( ) Supply Chain Management (SCM)

  ( ) Customer Relationship Management (CRM)

  ( ) Professional Service Automation

  ( ) Marketing Automation

  ( ) Quality Management

  ( ) E-Commerce

  ( ) Project Management

  ( ) Advance Planner and Optimiser/ Advance Planner and Scheduler

( ) Analytics

( ) Others (Specify)…………………………….

- Please mention the implementation details below
  - The period/s taken for ERP implementation (eg. 6 months, 2 years) ……………………………………………….
  - Year of going live…………..
  - Customisation Level (tick any one):

    ( ) Zero customisation

    ( ) Minor Customisation 1 to 10%

    ( ) Moderate Customisation 11 to 25%

    ( ) Major Customisation 26 to 50%

    ( ) Extreme/Full Customisation (Above 50%)
- Please mention the ERP implementation approaches (Please give tick marks)

  a. ( ) Big Bang

  b. Phased

     ( ) Module wise

     ( ) Branch wise
- Please mention whether your organisation has utilised the services of an external consultant in the planning and implementation of the ERP package (Please give tick marks in any one option)

  ( ) Yes

  ( ) No

Please mark your degree of agreement with regard to the following statements below (SA-Strongly Agree, A-Agree, N-Neither agree Nor disagree, D-Disagree, SD- Strongly Disagree) (Please tick any one option under each statement)

i. <u>Vendor Scalability</u>

▪ Ensured that the vendor can manage additional users in future.	SA	A	NN	D	SD
▪ Ensured that the vendor can manage the expansion of functionalities in future.	SA	A	NN	D	SD
▪ Ensured that the vendor had the potential to expand as per the market requirements.	SA	A	NN	D	SD

ii. <u>Vendor Viability</u>

▪ Ensured that the vendor was in the market for a long period.	SA	A	NN	D	SD
▪ Ensured that the vendor had experience in the same industry previously.	SA	A	NN	D	SD
▪ Ensured whether the vendor had enough experience in product updating and maintenance.	SA	A	NN	D	SD

▪ Ensured that the vendor had the history of successful ERP implementations.	SA	A	NN	D	SD
iii. <u>Consultant Scalability</u>					
▪ Ensured that the consultant can provide services to additional ERP users in future.	SA	A	NN	D	SD
▪ Ensured that the consultant can manage the expansion of functionalities in future	SA	A	NN	D	SD
▪ Ensured that the consultant had potential to expand as per the market requirements.	SA	A	NN	D	SD
iv. <u>Consultant Viability</u>					
▪ Ensured that the consultant was in business for a long period.	SA	A	NN	D	SD
▪ Ensured that the consultant provided service in the same industry previously.	SA	A	NN	D	SD
▪ Ensured, whether the consultant had enough experience in product updating and maintenance.	SA	A	NN	D	SD
▪ Ensured that the consultant had the history of successful ERP implementations.	SA	A	NN	D	SD
<u>v. Resource Mobilisation</u>					
▪ Resource mobilisation efficiency made organisational readiness for ERP implementation more effective.	SA	A	NN	D	SD
▪ Resource mobilisation efficiency helped in the selection of efficient vendor and consultant.	SA	A	NN	D	SD
▪ Resource mobilisation efficiency made the system upgradation more effective.	SA	A	NN	D	SD
▪ There was no interruption in ERP implementation due to non-availability of resources.	SA	A	NN	D	SD
<u>vi. Business Process Reengineering</u>					
▪ We are successful in identifying the business processes that require changes while adopting ERP system.	SA	A	NN	D	SD
▪ Successful in designing the new business process based on the new requirements of the company.	SA	A	NN	D	SD
▪ Successful in designing the new business process based on the software package requirements.	SA	A	NN	D	SD
▪ Successful in integrating the new business process with the ERP system.	SA	A	NN	D	SD

▪ The organisation was successful in adopting the changes happened in the reengineered business process.	SA	A	NN	D	SD

vii. Customisation

▪ Customisation helps in creating sustainable competitive advantage.	SA	A	NN	D	SD
▪ Customisation helps to eliminate the unwanted features in the ERP system.	SA	A	NN	D	SD
▪ Customisation helps to meet the needs and specification of each unit and departments.	SA	A	NN	D	SD
▪ Customisation helps to scale and change the implemented ERP system as per the new business requirements.	SA	A	NN	D	SD

viii. Data Migration

▪ We successfully filtered the outdated and unnecessary data to ensure data accuracy.	SA	A	NN	D	SD
▪ We ensured that all the migrated data are error free.	SA	A	NN	D	SD
▪ We ensured easy access to migrated data at any time.	SA	A	NN	D	SD
▪ The data migration doesn't interrupt the business operations.	SA	A	NN	D	SD

ix. System Testing

▪ Checked whether the developed ERP system is performing in various unexpected condition.	SA	A	NN	D	SD
▪ Checked whether the developed ERP system is performing as per the business requirements.	SA	A	NN	D	SD
▪ Checked the system recovery capability from different input errors and other failures.	SA	A	NN	D	SD
▪ Checked whether the system is stable as different subsystem integrates.	SA	A	NN	D	SD
▪ Ensured that the unauthorised access to data and resources are prevented and secured.	SA	A	NN	D	SD

x. End-user Training

▪ The training helps them to understand the usage of ERP system better.	SA	A	NN	D	SD
▪ The training improved employee's accuracy of work.	SA	A	NN	D	SD
▪ We are successful in providing continuous and specialised training.	SA	A	NN	D	SD

▪ We are successful in providing cross functional training programs.	SA	A	NN	D	SD
▪ The training helps to reduce confusion and conflicts among employees.	SA	A	NN	D	SD

xi. Software Upgradation (Please ignore this statement, if no upgradation happened yet)

▪ The software upgradation improved productivity.	SA	A	NN	D	SD
▪ The software upgradation helped to meet the prevailing market requirement.	SA	A	NN	D	SD
▪ The software upgradation helped to enhance the efficiency of business operations.	SA	A	NN	D	SD
▪ The software upgradation enhanced the accuracy of corporate data.	SA	A	NN	D	SD

Please provide your valuable suggestions to improve the ERP implementation process to get the best outcome in the light of your experience with the ERP implementation and usage.

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General information

- **About the organisation**

  Name of your organisation……………………………..

- **About the respondent**

  Your designation………………………………………..

  Years of experience with this organisation….………….

  Years of experience with ERP………………

Thank You...

Appendix II

QUESTIONNAIRE-GENERAL MANAGER

I am Shija T (Research scholar, Department of Commerce and Management Studies, University of Calicut, Kerala), conducting this study as part of my research work. I am inviting you to respond to the questions based on your ERP knowledge and experience in this firm. I am ensuring you that the responses will only be aggregated to the other responses from different manufacturing enterprises across India and only use for statistical analysis in the current PhD study. Any information contained in your response will be treated with strict confidentiality and in an ethical manner. I appreciate the time and effort.

ERP information

- Number of subunits/branches your business have…………………………..
- Please mention the number of subunits/branches implemented ERP……………………………………..
- Please mention the actual cost incurred for ERP implementation………………………………..
- Please mention the month and year of ERP implementation in your organisation…………….

Please mark your opinion with regard to the following statements below (A-Always, O-Often, ST-SomeTimes, R-Rarely, N-Never) (Please tick any one option under each statement)

i. Inbound Logistics

▪ ERP implementation reduced the lead time (differences-material ordering time and receiving time)	A	O	ST	R	N
▪ ERP facilitates the consolidation of shipments	A	O	ST	R	N
▪ ERP implementation helps to reduce the material cost	A	O	ST	R	N
▪ ERP facilitates the availability of required materials on time	A	O	ST	R	N
▪ ERP system tracks the surplus/missing items, if any	A	O	ST	R	N
▪ The ERP facilitates the inspection of materials received to ensure the quality	A	O	ST	R	N
▪ ERP facilitates the reduction of material wastage	A	O	ST	R	N
▪ It enhances safety during market fluctuations	A	O	ST	R	N

ii. Operational Excellence

▪ The real time tracking system helps to maintain the optimum stock level	A	O	ST	R	N
▪ ERP system facilitates bulk order placement	A	O	ST	R	N

▪ ERP facilitates reduction of total cost of production	A	O	ST	R	N
▪ We are able to reduce the cycle time in the order fulfilment	A	O	ST	R	N
▪ ERP system helps to meet the unexpected/ unusual demand of customers	A	O	ST	R	N
▪ Average time taken to respond a customer query is less than the industrial average	A	O	ST	R	N
▪ We are successful in providing the required proper information to customers	A	O	ST	R	N
▪ ERP implementation avoided the need of frequent auditing.	A	O	ST	R	N

iii. Outbound Logistics

▪ We are able to deliver shipments as per the quantity required by the customer	A	O	ST	R	N
▪ We are able to make shipments on time	A	O	ST	R	N
▪ We are able to make delivery of products directly to the customer's point of use	A	O	ST	R	N
▪ ERP implementation, reduced the risk of shipment to wrong locations	A	O	ST	R	N
▪ ERP facilitates delivery of goods without damages	A	O	ST	R	N
▪ ERP system helped to reduce the order fulfilment cycle time	A	O	ST	R	N

iv. Decision Making

▪ ERP implementation facilitates information integration of different departments	A	O	ST	R	N
▪ ERP implementation always enhances the information visibility / transparency	A	O	ST	R	N
▪ ERP integrated data facilitates healthy interactions among the users	A	O	ST	R	N
▪ ERP provided integrated information helps to identify problems in the business	A	O	ST	R	N
▪ ERP integrated information helps to identify alternative solutions to problems/issues	A	O	ST	R	N
▪ ERP integrated information often supports management to make decisions easier	A	O	ST	R	N
▪ The information sharing facilitates reduction in decision making time frame.	A	O	ST	R	N

v. Strategic Impact

▪ ERP system helps to enhance the bargaining power against suppliers and customers	A	O	ST	R	N
▪ ERP system helps to enhance the competitiveness of the organisation	A	O	ST	R	N
▪ ERP system helps to make product differentiation comparing to the competitors	A	O	ST	R	N
▪ The time take for new product launching in the market is lesser than the industrial average	A	O	ST	R	N
▪ ERP system supports business alliance (collaboration with other companies)	A	O	ST	R	N
▪ ERP system helps to create an added value for the organisation	A	O	ST	R	N
▪ We can respond quickly to ➢ Natural threats (e.g., Natural disaster, pandemics).	A	O	ST	R	N
➢ Competitive threats (e.g., New Competition, New Products, Pricing, Substitutes).	A	O	ST	R	N
➢ Operational threats (e.g., Supply chain disruption, theft and fraud, organisational change, regulatory risk, political risk)	A	O	ST	R	N

Please provide your valuable suggestions to improve the ERP functions in your enterprise in the light of your experience in ERP package.

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<u>General information</u>

About the organisation

- Name of the organisation…………………………….
- Year of establishment……………………….
- Industry…………………………………………………………………………

About the respondent

- Your designation…………...........................
- Years of experience with this organisation…………….
- Years of experience with ERP…………

Thankyou

Appendix III

EU KLEMS 72-industry classificatin (EUK72)

Code	Description	Industry No.
TOT	**TOTAL ECONOMY**	
AtB	**AGRICULTURE, HUNTING, FORESTRY AND FISHING**	
A	…AGRICULTURE, HUNTING AND FORESTRY	
1	……Agriculture	1
2	……Forestry	2
B	…FISHING	3
C	**MINING AND QUARRYING**	
10t12	…MINING AND QUARRYING OF ENERGY PRODUCING MATERIALS	
10	……Mining of coal and lignite; extraction of peat	4
11	……Extraction of crude petroleum and natural gas and services	5
12	……Mining of uranium and thorium ores	6
13t14	…MINING AND QUARRYING EXCEPT ENERGY PRODUCING MATERIALS	
13	……Mining of metal ores	7
14	……Other mining and quarrying	8
D	**TOTAL MANUFACTURING**	
15t16	…FOOD PRODUCTS, BEVERAGES AND TOBACCO	
15	……Food products and beverages	9
16	……Tobacco products	10
17t19	…TEXTILES, TEXTILE PRODUCTS, LEATHER AND FOOTWEAR	
17t18	……Textiles and textile products	
17	………*Textiles*	11
18	………*Wearing Apparel, Dressing And Dying Of Fur*	12
19	……Leather, leather products and footwear	13
20	…WOOD AND PRODUCTS OF WOOD AND CORK	14
21t22	…PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING	
21	……Pulp, paper and paper products	15
22	……Printing, publishing and reproduction	
221	………*Publishing*	16
22x	………*Printing and reproduction*	17
23t24	…CHEMICAL, RUBBER, PLASTICS AND FUEL PRODUCTS	
23	……Coke, refined petroleum products and nuclear fuel	18
24	……Chemicals and chemical products	
244	………*Pharmaceuticals*	19
24x	………*Chemicals excluding pharmaceuticals*	20
25	……Rubber and plastics products	21
26	…OTHER NON-METALLIC MINERAL PRODUCTS	22
27t28	…BASIC METALS AND FABRICATED METAL PRODUCTS	
27	……Basic metals	23
28	……Fabricated metal products	24
29	…MACHINERY, NEC	25
30t33	…ELECTRICAL AND OPTICAL EQUIPMENT	
30	……Office, accounting and computing machinery	26
31t32	……Electrical engineering	
31	………*Electrical machinery and apparatus, nec*	
313	………… *Insulated wire*	27
31x	………… *Other electrical machinery and apparatus nec*	28
32	………*Radio, television and communication equipment*	
321	………… *Electronic valves and tubes*	29
322	………… *Telecommunication equipment*	30
323	………… *Radio and television receivers*	31
33	……Medical, precision and optical instruments	
331t3	……… *Scientific instruments*	32
334t5	……… *Other instruments*	33
34t35	…TRANSPORT EQUIPMENT	
34	……Motor vehicles, trailers and semi-trailers	34
35	……Other transport equipment	
351	………*Building and repairing of ships and boats*	35
353	………*Aircraft and spacecraft*	36
35x	………*Railroad equipment and transport equipment nec*	37
36t37	…MANUFACTURING NEC; RECYCLING	
36	……Manufacturing nec	38
37	……Recycling	39
E	**ELECTRICITY, GAS AND WATER SUPPLY**	

Code	Description	Industry No.
40	…ELECTRICITY AND GAS	
40x	……Electricity supply	40
402	……Gas supply	41
41	…WATER SUPPLY	42
F	**CONSTRUCTION**	43
G 50t52	**WHOLESALE AND RETAIL TRADE; RESTAURANTS AND HOTELS**	
	…WHOLESALE AND RETAIL TRADE; REPAIRS	
50	**……Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel**	44
51	**……Wholesale trade and commission trade, except of motor vehicles and motorcycles**	45
52	**……Retail trade, except of motor vehicles and motorcycles; repair of household goods**	46
H	**…HOTELS AND RESTAURANTS**	47
I	**TRANSPORT AND STORAGE AND COMMUNICATION**	
60t63	**…TRANSPORT AND STORAGE**	
60	**……Inland transport**	48
61	**……Water transport**	49
62	**……Air transport**	50
63	**……Supporting and auxiliary transport activities; activities of travel agencies**	51
64	**…POST AND TELECOMMUNICATIONS**	52
JtK	**FINANCE, INSURANCE, REAL ESTATE AND BUSINESS SERVICES**	
J	**…FINANCIAL INTERMEDIATION**	
65	**……Financial intermediation, except insurance and pension funding**	53
66	**……Insurance and pension funding, except compulsory social security**	54
67	**……Activities related to financial intermediation**	55
K 70	**…REAL ESTATE, RENTING AND BUSINESS ACTIVITIES**	
70imp	**……Real estate activities**	
	………Imputation of owner occupied rents	56
70x	**………Other real estate activities**	57
71t74	**……Renting of m&eq and other business activities**	
71	**………Renting of machinery and equipment**	58
72	**………Computer and related activities**	59
73	**………Research and development**	60
74	**………Other business activities**	
741t4	**………… Legal, technical and advertising**	61
745t8	**………… Other business activities, nec**	62
LtQ	**COMMUNITY SOCIAL AND PERSONAL SERVICES**	
L	**…PUBLIC ADMIN AND DEFENCE; COMPULSORY SOCIAL SECURITY**	63
M	**…EDUCATION**	64
N	**…HEALTH AND SOCIAL WORK**	65
O	**…OTHER COMMUNITY, SOCIAL AND PERSONAL SERVICES**	
90	**……Sewage and refuse disposal, sanitation and similar activities**	66
91	**……Activities of membership organizations nec**	67
92	**……Recreational, cultural and sporting activities**	
921t2	**………Media activities**	68
923t7	**………Other recreational activites**	69
93	**……Other service activities**	70
P	**…PRIVATE HOUSEHOLDS WITH EMPLOYED PERSONS**	71
Q	**…EXTRA-TERRITORIAL ORGANIZATIONS AND BODIES**	72