Critical failure factor affecting Enterprise resource planning implementation in Indian manufacturing sector: A quantitative study

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ABSTRACT

PURPOSE – The purpose of this research is to illustrate the deficiencies that are causing increasing failure rates at Indian manufacturing sector. Sophisticated tools like ERP can be a challenging venture, and adopting technological system is an intricate process which causing risk of failure due to various internal and external factors. Around 75 percent of ERP projects are classified as a failure or continue to be painful and unfruitful. Exploring these deficiencies while considering previous literatures to determine a comprehensive list of critical failure factors in context of Indian manufacturing sector act as guidelines for successful deployment of ERP packages.

ORIGINALITY/VALUE – The outcome of this research will provide awareness about failure factors in the process of system implementation. The identification and prioritization of factor will act as input for building successful ERP framework.

Design/methodology/approach – Paper tries to explore critical failure factors at different stages of ERP implementation, quantitative research conducted with the help of survey instrument. A questionnaire distributed amongst participants who have active involvement in ERP project. These participants includes consultant, project management teams, management representatives, ERP vendors and end-users. The received data is analyzed with the help of SPSS statistical tool. And crucial factors amongst them are determined by using Pareto analysis.

Findings – Result of this study highlights the fourteen critical failure factor which are, lack of top management commitment, Absence of business process reengineering, software misfit, improper training and education, user resistance to change, weak testing and troubleshooting, inadequate project team composition, insufficient IT maturity, poor vendor support, over-reliance on heavy customization, tight schedule, poor user involvement, lack of communication, inappropriate legacy system and absence of monitoring and revaluation. For successful ERP integration, these factors need to be examine properly and eliminate them in pre and post-implementation phases.

Keywords – ERP failure, Critical failure factor, ERP implementation failure, Enterprise resource planning, Indian manufacturing sector.

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List of Abbreviations

Abbreviation	Description
APICS	American Production and Inventory Control Society
BOM	Bills of Material
ERP	Enterprise Resource Planning
IBM	International Business Machines
ICS	Inventory Control System
IDC	International Data Corporation
IT	Information Technology
LE's	Large Enterprises
MMAS	Manufacturing Management and Account system
MRP	Material Resource Planning
MRP II	Material Resource Planning - II
PICS	Production and Inventory Control System
SAP	Systems, Applications, Products
SME's	Small and Medium Enterprises
SPC	Statistical Process Control
SPSS	Statistical Package for the Social Sciences
SQL	Structured Query Language

Chapter 1: Introduction

1.1 Research background

Industrial practices in the early nineties were profoundly impacted by introduction of IT integration in manufacturing industries. Where firms like IBM notices significant benefits of these systems in manufacturing industries. In Germany, establishment of Systems, applications & product (SAP) 1972 initiated the era of ERP implementation. As Germany being a major manufacturing capital, these systems were hugely integrated all over the world within next few years. Whereas research conducted by Kale, Banwait and Laroiya (2010) conclude that 81 percent of Indian manufacturing sector is still complied with traditional system like MRP & SPC(Kale, Banwait and Laroiya, 2010). The small scale businesses who try to implement these tools are suffering failure due to misconceptions from ERP vendors and consultants. However, exposed global trade, business liberalization, competitive market schemes and rapidly changing product life cycle forcing these manufacturing industries for adopting systems like ERP.

Till now only large scales enterprises were able to afford these systems due to high infrastructure cost associated with them; however, innovation in personal computing proliferates ERP implementation like wildfire (Jacobs, 2007). After successful implementation of ERP packages in LE's, their business processes have dramatically improved. Thus they expect same from their suppliers. The chain is as strong as the weakest link. Therefore stimulated environment forced small sectors to have systematic tools like ERP (Amid, Moalagh and Zare Ravasan, 2012). Growth of IT sector in India has foreseen the significant magnitude of these manufacturing sector and initiated substantial investment on affordable ERP solution, within few years market is flooded with such ERP packages (Jahanyan, Dan and Upadhyay, 2011).

Even after decades of presence, ERP implementation still suffers from a high risk of failure. Recent cases like Hershey suffers from disrupted supply chain on Halloween (Cotteleer, Knowledge and Johnston, 2002), Nike losing sales order (Peci and Važan, 2015), Vodafone losing millions in Egypt (El Sawah, El Fattah Tharwat and Rasmy, 2008), FoxMeyer's bankruptcy due unsuccessful deployment (Wong *et al.*, 2005) shows significant risk of ERP failure, which drives many researchers to determine influential

factors contributing to system anomalies. According to statistics of IBEF (2014), 67 percent of MSME sector was classified as manufacturing units. Due limited resource capabilities, incompetence of user and insufficient IT infrastructure implementing cross-functional tools like ERP can be tedious process.

Many researchers conducted a study to construct success model for ERP implementation through determining Critical success factors. These factors are defined as key determinants of ERP success. However, there are minimum efforts on determining factors which can cause failure in implementation, which might arise due to deficiencies in the system. This study is profoundly focused on Critical failure factors in ERP implementation with context with Indian manufacturing sector.

1.2 Document Structure

The first chapter gives a background, presenting a basic introduction to what are the flaws within the system, the value behind the research, and the need of the study. It also justifies the seriousness of the study with respect to Indian manufacturing sector. The next chapter presents review of different aspects associated with ERP system, system analysis, states & scope about the spread of the system and critical failure factors which are responsible for failed implementation. The next chapter provides methodologies through which data is gathered, from whom it is collected and its justification, how it is analyzed, and how it will provide ingredients of ERP implementation success. The next chapter provides statistical data analysis and final chapters list down the key factors, shortcomings, future scopes of this work, and findings of this research.

Chapter 2: Literature Review

2.1 ERP Introduction

The early ages of flatter organizational structures are completely changed when software engineers recognized the advantages of data integration into a unified system which can collect, analysis and illustrate the combined information into a single platform. According to APICS Dictionary, these systems are defined as a "framework for organizing, standardizing and defining the business processes necessary to effectively plan and control an organization so the organization can use its internal knowledge to seek external advantage" (Blackstone and Cox, 2005). The whole system is designed to serve as business process house within distinct functional areas of organization which includes finances, accounting, inventory, quality, sales, marketing, human resources, etc. To understand the origin of these systems first we have to understand its predecessor MRP (Material resource planning).

2.2 MRP & Beginning of ERP

The functional aspect of the ERP are derived from its predecessor which are MRP (Material requirement planning) and MRP II. These systems are introduced into the manufacturing sector to eradicate the issued like inadequate accountancy and redundancy in production, planning & inventory control. The introduction of these systems were made in early 1960 through joint efforts of J.I. Case and IBM. An earlier version of PICS (Production and inventory control system) which used to collect the data in the magnetic tape which then collectively called as master. These practices than got advanced with technologies which result into additional integration to different department of organization. While foreseeing the prominent benefits of IT integration into manufacturing industries software engineer are driven to design the package which integrates whole process of organizations into the graphical user interface. In 1972, A firm named SAP started to integrate these systems in Large Scale organizations at Germany, where they got global acceptance within next few years.

Year	System / Events	Description
1960	ICS, Forecast System	Computers in business application
1970	Material Requirement Planning (MRP)	Software integration in Bills of Material, Inventory masters & Material procurements
1972	SAP	Introduction of SAP into Germany
1975	Manufacturing management and account system (MMAS)	System developed by IBM to integrates sales operations
1977	Oracle's SQL	Structured Query Language where introduced, which incorporated Database management practices in MMAS
1978	SAP R/2	Software which can utilize mainframe computer system at its extent
1981	UNIX	Introduction of multiuser operating system
1989	MRP-II	Closed loop inventory management & planning systems
1990	Early ERP	ERP system integration into Business processes amongst LE's
1991	Personal computing and Enterprises computing	Trend of personalized computers reached at globalized theme
1991	ERP widespread	
1992	SAP R/3	True ERP based system by SAP
1998	SAP Dominance	Takes control as ERP vendor all over the world
2000	Y2K	Implementation of risk management into ERPs system due to anxiety of Y2K
2001	Ease of ERP implementa-tion throughout the globe	Rapid growth in numbers of ERP packages, vendors and consultants.

Table 1: Evolution of ERP- System introduction and influential events source: (Jacobs, 2007)

2.3 ERP Adoption

ERP adaption is defined as technological adaption while considering changes and adjustment to the legacy system. While ERP vendors presume that packages like these are universally accepted and practiced by numerous organization, adaption can be very

difficult if organization contexts and process does not match with the system. According to Hong and Kim (2002), a feature-function fit of ERP and organization can result into ease of implementation as it offers lower resistance to adjustment. Thus ERP implementation incorporates pre-installation process, which can act as a key stag for successful ERP implementation. Apart from that system like ERP needs to be run on actual environment to determine the flaws and errors in the system (Parr and Shanks, 2000). These are considered as post-implementation processes. All these steps are need to be carryout before deployment of the ERP to ensure fit between the organization and implemented system. ERP implementation process can distinguished into four phases, which are characterising phase, project phase, shakedown phase and onward-upward phase (Nah, Lau and Jinghua, 2001).

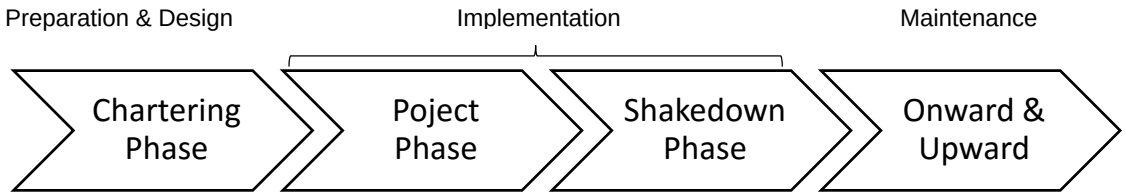

Figure 1: Phases of ERP implementation Source: (Nah, Lau and Jinghua, 2001)

In contrast some research claims ERP implementation as a business project rather than technological initiative (Markus and Tanis, 2000). There are many researchers who contributed their work towards implementation processes and stages amongst them a researchers from MIT, Ross and Vitale (2000) proposed five phases of ERP implementation model by studying 15 cases of ERP. These phases include design, implementation, stabilization, continuous improvement and transformation. The design phase is concerned with selection of ERP package, system reengineering and incorporating changes. The implementation phase involves steps for software configuration and implementation. Stabilization process consists of software testing and troubleshooting. The final stage, which is improvement stages were continuous feedback and modifications are made until maximum efficiency is achived. Understanding these phases are essential to comprehend the chronology of factors influencing the success or failure in ERP system.

2.4 ERP in the Indian manufacturing sector

The origin of the ERP is deeply amalgamated with manufacturing industries were most of the ERP packages are designed for the LE's. Whereas, according to IBEF annual report 67 percent of SME's in India are categorized as manufacturing units (IBEF, 2014).

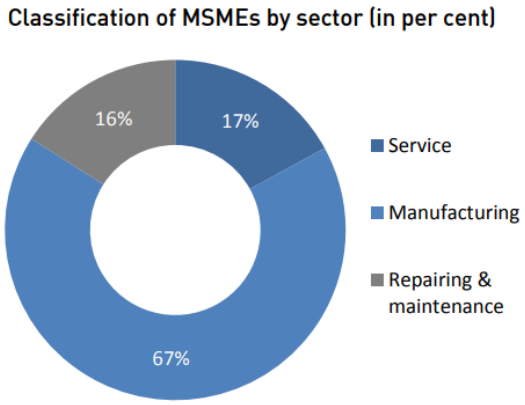

Figure 2: Annual Report FY 12 of the Ministry of Micro, Small And Medium Enterprises source: (IBEF, 2014)

Using strategies of LE's for implementation in SME's can result in sluggish, tedious and inefficient deployment (Huin, 2004). The difficulties which might arise in SME's while ERP implementation are due to insufficient resources, inadequate or no consultant, part-time dedication of employees and incompetence of vendor.

The ERP implementation process demands substantial investment of money and time. However, incompetence amongst user will eventually lead to poor system utilization. Most of the manufacturing industries are only utilizing ERP functionalities for Inventory management, material procurement and forecasting. were these packages comprise of high potentials and can integrate the complete process of business. This misconception of organizations where they cannot distinguish between MRP and ERP systems are the main reason behind the low return of investment from ERP system and eventually classified as failure (P Soja, 2006).

High-cost association of IT infrastruture and high-end ERP packages might hinder these organization; however, growing IT companies are heavily investing in cheaper ERP solution (Jahanyan, Dan and Upadhyay, 2011). These pre-configured packages are easy to implement within stipulated time and also known as 'Vanilla ERP'.

2.5 Incompetence and barriers in Indian manufacturing sector

India has done significant growth in IT industry where it known as highest software outsourcing countries. However, the manufacturing sector of India lacks in terms of IT tools implementation and diffusion (Jahanyan, Dan and Upadhyay, 2011). The first SPC tools like MRP have introduced decades ago where boost to these tools is decelerated due to language barriers, incompetence of workers in IT and user resistance to change (Palvia and Huang, 2001). Especially in SME's (MSME) sector the ERP penetration was delayed due to IT maturity amongst manufacturing industries. Apart from that these industries are showing significant growth from past few years, 75 percent of ERP growth has been recorded from past 6 years (IBEF, 2014).

2.6 ERP market in India

The first significant ERP implementation in India was held by HLL, ONGC, ESSAR, Godrej Soaps, Cadbury, Century Rayon, Sony India Pvt. Ltd., Citibank, ACC, ANZ Grindlays, German Remedies, Blue Star, Mahindra & Mahindra, Rallis India, Ceat Ltd., Indal, Ford Motors, Kirloskar, Knoll Pharmaceuticals, and Glaxo (Amid, Moalagh and Zare Ravasan, 2012). In early exposures, LE's in India implemented these practices to improve the effectiveness and efficiencies of the system. Which indirectly result in external competitiveness. Once they achieve the efficiency they expected the same from situated bodies like vendors and suppliers. Thus these bodies are forced to adopt the same practices to thrive in an efficient environment. After ERP implementation organization understand that system is only efficient as the weakest link in the organization therefore to have complete supremacy ERP must operate at all levels. Initially the ERP solutions like SAP and Oracle focused the LE's, which have turnover over 2 billion rupees, where total cost of the system anticipated as one to two percent of their gross income. Within a stipulated time the whole environment was thriving towards the ERP implementation. Manufacturing industries like steel, consumer equipment, textile and automotive have heavily manifested with ERP (Amid, Moalagh and Zare Ravasan, 2012). However, the small scale industries were not able to afford such instrument due to huge investment. Where software companies like Tally Solutions, Suchan softwres, Microsoft and Udyog software come with the concept of 'Vanilla ERP'. These ready-mades package is sold and implemented by vendor itself. Soon the whole SME's industries where targeted by

software tycoons from Bangalore and Mumbai, and market was flooded with ERP packages.

2.7 ERP implementation failures

The tools like ERP are present from more than a decade; still there are numerous cases where organizations are failed to construct a stable ERP system or project is shelved due to delay and inability to replicate legacy system. Recent cases like Hershey, Nike where ERP implementation failed due to disruption in supply chain (Wong *et al.*, 2005). Vodafone in Egypt where failed implementation cost millions of dollars (Uhl and Gollenia, 2016). HP's attempt to centralization of business processes through SAP went wrong in 2004 (Peci and Važan, 2015). FoxMeyer's bankruptcy after ERP failure due to poor consultant effectiveness (Addo-Tenkorang and Helo, 2011). Which illustrates the clear implication of ERP implementation flaws and seriousness of the issues to be considered. According to Al-Mashari (2003), 70 percent of ERP implementation are resulted in failure due to insufficient return of investment.

2.8 Internal and External contributor in ERP implementation

For successful ERP implementation organization demands discrete skills and knowledge such as technical, IT, business-oriented and process-oriented. Which cannot be delivered by a single entity. Due to this implementation process can involve multiple internal and external entities and equal participation of each member is very crucial.

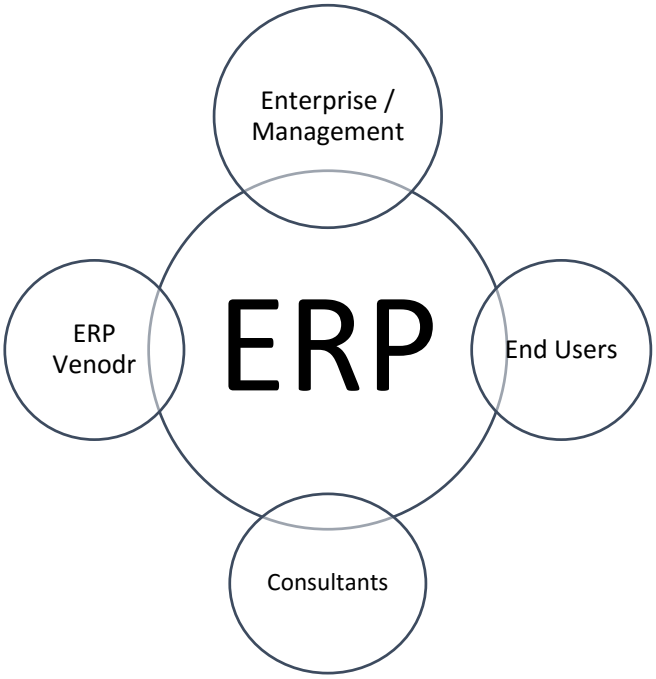

Figure 3: Participants in ERP implementation

- Enterprise or Top management: In ERP implementation involvement of top management plays a vital role as incorporating a new system requires process adjustments which are not possible to mandate without authorization of management bodies (Aminuddin, 2016).
- Vendor: Vendors are the person or organization who owns the whole rights and responsibility of ERP packages. The participants who are aware about capabilities and limitations of the system which can become a valuable asset while implementation processes (Aremu and Shahzad, 2015).
- Consultants: Consultants are the only bodies which might not present in the small scales ERP implementation. However, in LE's they act as midbrige between organization and vendor to provide adequate ft between software and firm (Snider, da Silveira and Balakrishnan, 2009).

- End-user: End-user or employee are the bodies who are eventually defines the efficiency and effectiveness of the system. As without user the system won't able to input or process the data (Snider, da Silveira and Balakrishnan, 2009).

2.9 Critical Failure Factor

2.9.1 Lack of top management commitment

ERP implementation is a process which needs change in organization in form of business process and structure while improvising new data collection and reporting means. These additional task are assigned with the help of consultants which act as external forces to govern the whole mechanism. Therefore these assessments are inadequate without the involvement of the members within an organization. According to Liang *et al.*, (2007) the effect of these assessments do not affect organization until involvement and control of the critical organizational agent (top management). Furthermore he also states that these internal agents are acting as primary aspects who translates external inputs into managerial actions, such as change in policy and organizational structure. These boundary spanning role has significant impact on process of implementation as top management agent can import external knowledge while considering internal environment (Mitchell, 2006). These agents can also incorporate organization culture which can permeate ease of change in form of rules, regulations, and routines, which can act as powerful templates towards implementation success (Purvis, Sambamurthy and Zmud, 2001). In the times of conflict the adequate mediation can be achieved with the help of these standards (Vessey and Brown, 1999).

Apart from leadership, providing necessary resources is also key ingredient in terms of ERP success. Involvement of top management can ensure the utilization of necessary resources while maintaining efficiency and effectiveness of organization process (Zhang *et al.*, 2003). Top management should involve the required people, time and valuable resources for implementation efforts. The derived system must share the same vision as legacy system and structure the communication between the managers and employees.

Without the intervention of senior management, the implementation stages got compromised while waiting for approvals and acceptance from internal bodies. While

scope and aim of the project are not clearly defined can cause conflicts in departments (Bhattacherjee, 1996; Holland and Light, 1999; Aladwani, 2001; Garg and Garg, 2013).

2.9.2 Poor consultant effectiveness

The selection of consultant might highly affect the implementation due to their possession of specialized knowledge and experience in the field of ERP. These are the external bodies hired to fill in the knowledge and incompetence of the project (Vessey and Brown, 1999). Therefore, having an excellent external agent can provide excessive and instantaneous supports towards technical difficulties and systematic errors. Effective communication from consultant can provide strong foundation and trustworthy relationship between organization member and users. The degree of effective communication will directly imply the knowledge transfer (Maditinos, Chatzoudes and Tsairidis, 2011). An increased level of knowledge transfer of ERP system can help user exploit the new tool to its full potential and achieve maximum benefits from it in the future.

However, the consultant who is unable to provide proficiency of communication skills, knowledge transfer, issue resolution and project planning will unable to fill gaps and eventually results in delayed schedule and over budget (Ngai, Law and Wat, 2008). In the past years there is number of cases where inadequate consultation have failed the ERP implementation. For instant, forestry product manufacturer which hired four consultants for their SAP integration, which results in conflict amongst themselves for control over the project, which eventually fails to complete the project (Garg and Garg, 2013; Panorama consulting group, 2018).

2.9.3 Poor user Involvement

User involvement plays a vital role in successful ERP implementation due to ultimate goal of the ERP system is to achieve efficiency in business processes, which directly implies towards the acceptance of system by users. These systems are considered as failure if technology is not used or the intended degree of usage is not achieved (Amoako-Gyampah, 2007). As stated by Davis, Bagozzi and Warshaw (1989), the Computer system is not able to improve performance of organization until they are not used properly. This unappreciated approach towards system will lead to complexity in integration with

legacy system. The usefulness of these systems can be defined as the degree of beliefs an individual has while using such system (Davis, 1985).

The active participation by the user can also improve the control over the whole project plan. Which also helps users and ERP vendors to maintain a balance between expectations and actual need. however, the employee who is not part of the project team or get excluded from the implementation process can resist the changes. Apart from that user's involvement can help in identifying the issues related to the system in early stages (Brown, Vessey and Powell, 2000). As the users are active part of the implementation they can efficiently gauge their expectations, which can accelerate the implementation process.

Few organizations who restrict their resources have part-time participants. These participants have routine work of organizations apart from implementation process. There is numerous literature suggest that part-time dedication can result in work (Shanks *et al.*, 2000; Umble, Haft and Umble, 2003; Wong *et al.*, 2005; Snider, da Silveira and Balakrishnan, 2009).

2.9.4 Absence of business process reengineering

Reengineering is a process of fundamental rethinking and structural redesign by which business process can achieve dramatic improvements. These improvements can be related to speed, service, quality or cost (Hammer and Champy, 2004). The whole purpose of reengineering is to avoid heavy customizations and redundancy. In a nutshell, reengineering involves tossing out the legacy system and making a fresh start from scratch. The remolding of the business processing into the best business standards followed by industry to minimize failure rate and uncertainties (Muscatello and Chen, 2008).

For successful implementation, BPR plays a vital role, and the absence of them can cause tremendous consequences. However, successful implementation can lead organization towards efficient business practices. Ford was able to reduce their employees by 75 percent by applying BPR in account payable process apart from that IBM was able to reduce cycle time of their credit application process by 90 percent (Hammer, 2000; Attaran, 2004). These numbers clearly illustrate the benefits of Business process

reengineering. In contrast, If employees or any internal agent who does not have enough details about purposes of BPR can feel uncertainty about their jobs, which can stumble the reengineering process(Zhang *et al.*, 2003), where managers should have active participation to make strategy understood by participants in form of formal communication which can enrich the process of ERP implementation.

2.9.5 Inadequate project team composition

Implementation of these complex system demands cooperation and efforts of team members and external agents. The team must have cross-functional or balance composition of participants (Sumner, 2003; Princely, 2008). If team is not properly composed, they will not able to collaborate the informational need and support, leading towards incorrect system configuration (Akkermans and Van Helden, 2002). A weak team member who unable to monitor, manage, or lead the project can result in disruption or system in future. Besides, involvement of the manager and authorized person into the team needed to make effective and quick decision when needed (Parr and Shanks, 2000; Shanks *et al.*, 2000). Apart from that project implementation should be their first priority where workload amongst them should be evenly distributed. Which can be only possible if organization facilitate the project by co-locating team together (Garg and Garg, 2013).

The article examination showed ‘team composition’ as frequently cited critical factor. Which illustrates need for skilled and competence member from both internal agents as well as external consultant are essential for successful implementation, improper team assessment can lead the project into abortive stage or failure (Holland and Light, 1999; Nah, Lau and Jinghua, 2001; Sumner, 2003; Bhatti, 2005; Garg and Garg, 2013; Moalagh and Ravasan, 2013).

2.9.6 ERP software misfit

While adopting systems like ERP, organizations should select appropriate software that fits with existing business practices and processes (Law and Ngai, 2007). Implementing a package with highest degree of fit and smallest gap will shrink the cost, efforts, time and risks in system implementation (Ngai, Law and Wat, 2008). According to Holland and Light (1999), inappropriate ERP package or strategy can lead whole project into non-

conformities and failure. As there are numerous packages and vendor currently present in market which makes selection tedious. However, a good vendor selection can be beneficial from excellent technical assistance to adequate user training (Sumner, 2003; Zhang *et al.*, 2003; Princely, 2008).

While the presence of vendors like SAP, oracle, Udyog ERP are providing excellent support for flexible ERP solutions. However, there are examples like Dell, who has to scrap their entire project because system was inelastic for their global operations, which cost them approximately 10 million dollars (Møller, 2005). As stated by Wong *et al.*, (2005), Enterprise system can utilize in a very reduced amount due to problem of misfit.

2.9.7 Over-reliance on Heavy customization

Heavy customization is a factor which directly correlates with the package misfit. Due to change in process between the organization and ERP system there is need of customization which can cause implementation delays, overspending and non-conformities (Wong *et al.*, 2005). The cause of these reasons can be inadequate testing, unresolved system bugs or poor quality of customization. Syntax error generated by package due to incompetence of programmer while customization is prevalent in case of small scale ERP vendors. Apart from that, customization can lead to abandoning of best industrial practices embedded in ERP system. In a journal published by Holland and Light (1999), studied a case of Statco. Statco is a major stationary suppliers in Europe who choose not to customize the ERP system (SAP) which results in successful integration and rapid deployment. Choose to customize or not can be a difference between successful or unsuccessful projects, were successful companies always tries to change the process to fit the package than to stick to the legacy system (Roberts and Barrar, 1992). Following the research published by Snider, da Silveira and Balakrishnan (2009), were they studies cases of ERP implementation of 5 Canadian firms in which they asked a question to a team member about performance of the package after modification which he replied as, “Where we had those software problems of fixing one thing and unfixing another –we thought the two things were totally unrelated. We would not even have thought of testing it.”

Resistance to change can be significant psychological barrier to cause heavy customization however, customization can lead to numerous testing and troubleshooting lead to ERP dissatisfaction in future stages (Scheer and Habermann, 2000).

2.9.8 Improper training and education/competence

Limited knowledge and training of the legacy system, as well as ERP fundamentals, can mislead the project. If users do not have fundamental knowledge of ERP then they are not ready to get involved in implementation processes. In many cases the project can be shelved due to users do not realize the essentiality of ERP, which causes resistance to change (Holland and Light, 1999). Managers and higher authorities must have active participation in securing training and resources needed by the process. If they are not ready, then organizations should provide them proper training and (Nah, Zuckweiler and Lau, 2003). According to Zhang *et al.* (2003), lack of training can be critical part of the ERP implementation where training should be subsidized with adequate investment and scheduled sessions to provide sufficient competence (Sumner, 2003). Wherewith, the proper training users, can feel confident and feel enthusiastic about possibilities with new system and lead project with positive manner (Plotkin, 1999).

The balanced between routine work and training can be challenging, where implementation demands overtime efforts and excessive dedication from team members (O'Leary, 2000). Just like user involvement training helps users to improve quality of ERP project apart from that live session from vendor can eradicate the issues situated with the system (Shanks *et al.*, 2000). Whereas, training can also help employees understand the processes where how one's work influence others and how whole organization is integrated with each other (Bhatti, 2005).There are numbers of Journals identifying poor training and competence as a critical factor for failed ERP projects (Holland and Light, 1999; Nah, Zuckweiler and Lau, 2003; Zhang *et al.*, 2003; Princely, 2008; Snider, da Silveira and Balakrishnan, 2009).

2.9.9 Unrealistic expectation

Expecting enormous amount of changes without considering internal context can result in ERP failure. The top management should consider prominent consequences, risks and

complexity of processes before ERP adoption. Initiation of ERP setup without prior research or before understanding fundamental terminologies about ERP can result in unrealistic expectation. Which then lead to peripheral project planning where lack of knowledge and resources hinders or delayed implementation process and eventually fails (Wong *et al.*, 2005). Top management, team members, consultants, and users should have a clear vision about budget, functionality, complexity and integrity of the project before implementation. Conflicts between vendors and organization can reduce the quality of system while degrading moral of the employees (Martin *et al.*, 1999).

2.9.10 Lack of communication/knowledge transfer

Implementing cross-functional system like ERP needs transparent behavior amongst all participants and departments, where communication is a key which ensures systematic functionality (Chmielarz, 2016). Which is evident since primary motive behind implementing ERP is to have system integrated functions (Singla and Goyal, 2005). The employee should be well informed about activities, objectives, scope and updates of implementation processes (Sumner, 2003).

Effective communication between vendors and users ensures good transfer knowledge, which allows efficient use of ERP packages, which can also affect their training and understand. Their communication should be adequate to provide sufficient support to ERP system (Wong *et al.*, 2005).

2.9.11 Tight Schedule

Pressure from top management or low resources allocation can result in tight schedule. Thus implementation activities are carried out in rush, which can have adverse effect on ERP projects. Limited timespan can make user overloaded where they might generate higher resistance to change, which have significant impact on business process reengineering (Holland and Light, 1999; Wong *et al.*, 2005). Poor BPR can results in customization in ERP packages, which then attach a new process of testing and debugging. Employees having overload of routine work and implementation processes can make them exhausted while it can affect transfer knowledge. In general it can deteriorate the quality of ERP packages (Brown, 2010).

2.9.12 Insufficient IT maturity

Mainstream ERP packages like SAP and Oracle have a high demand for processing power thus required servers or high configuration system. However, manufacturing sectors in India have a massive amount of SME's who have restricted budget on their implementation. Therefore these organizations turn towards lite packages which can run on client or thin client systems. For some organization it becomes necessary to upgrade or revamp their IT infrastructure (Kumar, Maheshwari and Kumar, 2002; Lindley, Topping and Lindley, 2008). Poor IT infrastructure results in slow processing, which become a hassle for user to perform multiple operations and finally runes the ERP experience.

2.9.13 Weak development, testing and troubleshooting

Weak development, testing and troubleshooting can result in poor configuration and deteriorates the overall quality of ERP packages. Adequate testing of ERP architecture is crucial in every stage of ERP implementation, negligence of testing can results in software malfunctioning at multiple events which are very hard to debug. Finally the whole ERP package can results in failure due to its tedious root cause analysis at the time of software deployment. Elimination of bugs at early stages of ERP implementation through multiple testing ensures smooth flow of implementation concerning organization process and structures (Nah, Lau and Jinghua, 2001).

ERP vendors, consultants, managers and team members should resolve the issues while compilation of programs and GUI framework. Quick response, patience, preservation and problem-solving capabilities of vendor and timely involvement of users can results in superior troubleshooting thus results in bugless interfaces of ERP (Nah, Lau and Jinghua, 2001). Apart from that testing results indicate readiness of participants and organization for deployment of final configuration, were participants are equipped with high degree of fundamental knowledge, skills and confidence about project (Wong *et al.*, 2005). The issues found after the ERP deployment can be results in excessive stress and workload as resolution of issues can add up daily activities amongst team member or users. Sometimes it can freeze routine work of organization as troubleshooting demands multiple boot or maintenance of server (Lindley, Topping and Lindley, 2008).

The negligence of final testing before ‘go live’ can build a huge risk system disruption. For instance absence of testing will result in additional debug sessions from vendors, which cause frustration amongst users and vendors. Apart from that it deteriorates the quality of ERP package due to this many researchers indicates Poor testing and troubleshooting as a significant failure factor and it can only eradicated by punctual testing and debugging with involvement of users and managers (Nah and Lau, 2001; Akkermans and Van Helden, 2002; Wong *et al.*, 2005; Levy and Powell, 2006; Piotr Soja, 2006; Shahin and Sulaiman, 2011).

2.9.14 User’s resistance to change

There numerous research to determine factors which influencing user’s resistance to change for systematics tools like ERP. Amongst them, Aladwani (2001) characterized two means of user resistance, which are habits and perceived risk. Habits referred as psychological lean towards routine practices and perceived risk involves user’s mindset about risk involved while adopting new practices. To overcome these barriers, the involvement of top management is very crucial.

IT maturity also plays a significant role which involves high risk of user resistance, if the user does not have competence in computers than he certainly feels the system as undesirable. The resistance to change from user can lead to poor quality of data insertion. Which can obstruct the process and cause issues to connected departments (Wong *et al.*, 2005).

2.9.15 Poor vendor support

The implementation of this cross-functional system needs massive amount of support from ERP vendors. The need is quite evident as the vendor has extensive experience, expertise, and skills needed for successful implementation. Reduced vendor assistance can result inadequate training schedules and improper knowledge transfer. Quality service and assessment of employee within a quality domain knowledge can ensure streamlined implementation. Vender should comply with authorization rights needed for integrating the ERP packages into operating system, manuals and other documents whenever needed by consultant or organizations. A genuine assistance from vendor can

results in good transfer of knowledge, adequate training for participants, quality ERP packages and proper planning for project.

2.9.16 Obscure business plan or Vision

An unclear vision can steer the project into wrong direction, which is undesirable throughout the implementation life cycle (Nah and Lau, 2001). Scheduled plans and outlines play strategic roles which can contribute towards tangible benefits, economy and punctuality of the project. Which are only possible if the contributors are well aware of vision of the organization (Bhatti, 2005).

There should be a coherent process model of how an ERP package should operate between different departments. Each process or additional activities should justify the need and benefits of the organization. Results from them should be tracked and monitored and if they do not serve their purpose adequately they should be eliminated before deployment of the project (Holland and Light, 1999). While reengineering the processes should be wisely implemented as these can demand resources of the organizations, inferior planning and scheduling make system inefficient and unpleasant (Shahin and Sulaiman, 2011).

2.9.17 Inappropriate business & IT legacy system

The legacy system illustrates the current structure, culture and IT maturity of the system. Which should be carefully examined to identify nature and scale of possible issues that organization could face through system implementation (Nah and Lau, 2001). Understanding the existing system is crucial part of implementation as ERP packages demand systematic as well as technological changes through the intermediate phase. The whole purpose of evaluation is to determine level of sophistication can be implemented as every department plays a crucial part in EPR system. If the legacy system has few broken links which then need to be established to have desirable input which can ensure flawless operation of these packages (Dezdar and Sulaiman, 2009).

2.9.18 Absence of monitoring and evaluation

In shakedown stages of ERP implementation, the effectiveness of the process needs investigation. The progress of the implemented phases and targets needs to be measured and monitored to ensure proper functioning of the project after deployment. Apart from functionality system should be measured against target dates, resources utilized and cost. The evaluation of system can be made with the help of regular feedback from system as well as participants (Holland and Light, 1999). The monitoring data should be well organized and presented in front of top management. Transparency about the project can result in involvement of resources and helps in bounding expectations.

2.9.19 Cost Over-Runs

Integrating tools like ERP is costly due to system demands addition or elimination of new processes as well as installation of new IT infrastructure. Apart from tangible resources the project also needs experience individuals, expertise from vendor and cross-functional knowledge of technical aspects which can demand additional resources which are not computed earlier. Sometimes IT infrastructure may need upgrade to process additional operations (Lindley, Topping and Lindley, 2008). These unexpected costs can lead dispute amongst organization and vendor and lead project towards failure.

2.10 Summery

2.10.1 Complete list of Critical failure factors

The critical failure factors examined from previous literature are listed below:

No.	CRITICAL FAILURE FACTORS
1	Lack of top management commitment
2	Poor consultant effectiveness
3	Poor user Involvement
4	Absence of business process reengineering
5	Inadequate project team composition
6	ERP software misfit
7	Over-reliance on Heavy customization
8	Improper training and education / competence
9	Unrealistic expectation
10	Lack of communication / knowledge transfer
11	Tight Schedule
12	Insufficient IT maturity
13	Weak development, testing and troubleshooting
14	User's resistance to change
15	Poor vendor support
16	Obscure business plan or Vision
17	Inappropriate business & IT legacy system
18	Absence of monitoring and evaluation
19	Cost Over-Runs

Table 2: List of Critical failure factors in ERP implementation

2.10.2 Critical Failure factors into implementation phases

To construct the success model for ERP implementation, is it necessary to understand the chronology and existence of these critical factors into implementation phases. This stage is necessary to predict the non-conformities might arise due to inadequate or over-

exaggeration in efforts and resources. Elimination of theses factor before implementation is critical for successful implementation; however, it can be achieved if organizations, vendors, consultants or end user are aware of these factors in their respective phases. Therefore understanding the chronology of these factors might help organizations to mitigate issues (Nah and Lau, 2001).

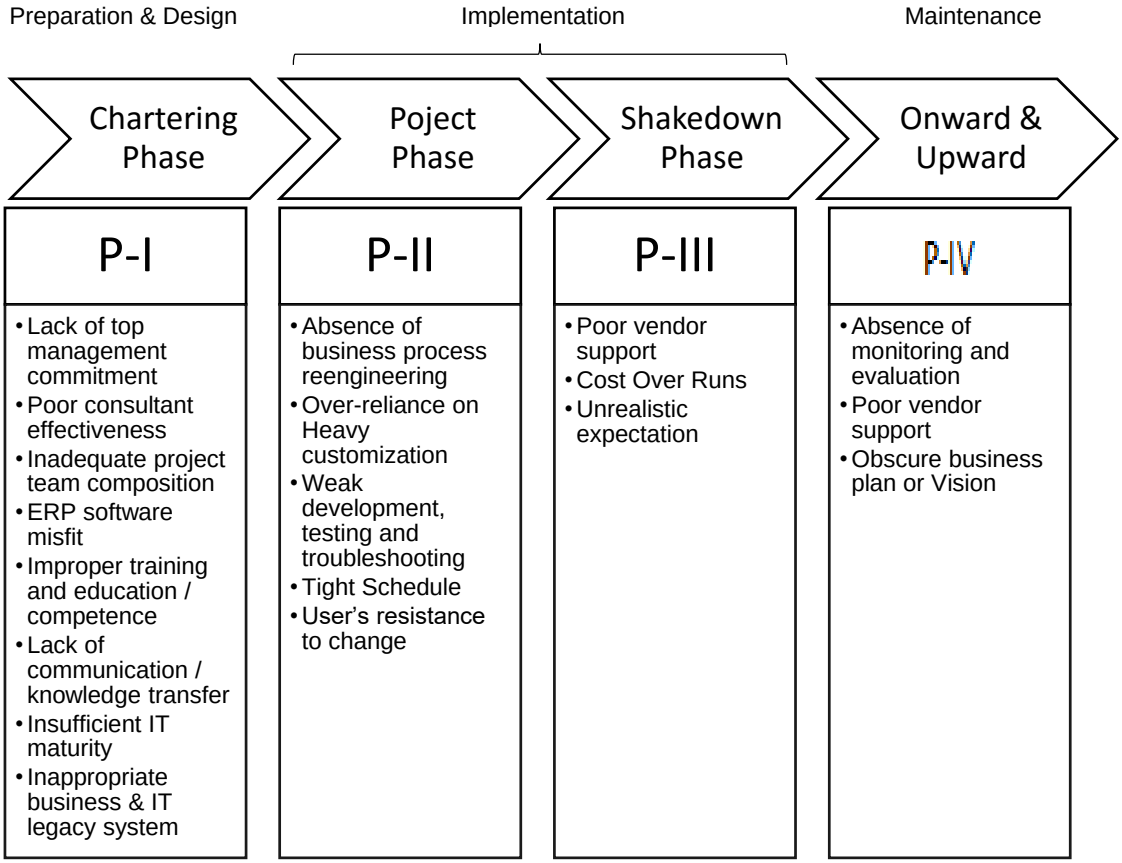

Figure 4: Chronology of CFF in implementation phases Source: (Nah and Lau, 2001)

Chapter 3: Scope of research, Research Aim and Research Question

3.1 Scope of Research

With implemented ERP system organizations can achieve improved efficiency from adopting the best industrial practices, Top amongst fortune 500 firms are shared common factor that they have integrated all function successfully through ERP packages (Brown, 2010). However, in many cases ERP implementation had turned into devastating effects (Cotteleer, Knowledge and Johnston, 2002). This research attempts to reolves this issue through evaluating critical failure factors which need to concern in pre-implementation phases.

3.2 Research Aim

This research aims to determine implementation stages ‘where things might go wrong’. The study from previous literature reveals that most of the project share the same deficiencies, which results in ERP failures. These deficiencies might be in any form. To resolve such issue active participation of consultant, top management, end-user and ERP vendor plays crucial role.

The complete objective of this research can be defined by the following steps:

Step 1: Identify the factors which causing deficiencies in system resulting in ERP failure

Step 2: To create a comprehensive list of this factor to construct instrument for analysis

Step 3: From gathered primary data, determine degree of influence of each factor to provide list of factor in descending order, and finally determine most affective factor amongst them to derive ERP success model.

3.3 Research Question

The research attempt to answers the following questions as their primary objective.

- What are the critical failure factors (CFF) causing failure in ERP implementation at Indian manufacturing sectors?
- Is it possible to identify and categories influencing failure factors with context of Indian manufacturing sector?
- What are the critical failure factors that should be taken into high priority to avoid implementation failure at Indian manufacturing sector?

Chapter 4: Methodology

4.1 Introduction

The primary purpose of this research is to determine the failure factors in ERP implementation. This study is focused on the manufacturing sector in India, the main reason to select Indian manufacturing sector is that it has statistical limitations,while implementing sophisticated tools like ERP. The study aims to fill the existing gap between identification and elimination of critical factor which leads to failure of system. Two-phase approach was used to determine these factors, which are as follows:

Phase 1: Develop a comprehensive list of critical failure factor through collection of data from existing literatures. List down the factors influencing failure in ERP implementation in Indian manufacturing sector.

Phase 2: Established a structured questionnaire (survey containing open ended questionnaire), this instrument is distributed amongst wide range of participants who play crucial roles while implementation process. The groups consist of ERP consultant, ERP vendors, Project management members, Top management of the organization and user. The data gathered from this survey will go through reliability test and furnished to construct list of factors influencing ERP implementation failure in hierarchical order.

4.2 Research Philosophy

Research question is the essential aspect to initiate the further research , however before elaborating about the data collection and analysis techniques, we need to peel of the outer layer of research onion. Where the philosophy clearly illustrates the development and nature of that research. The philosophy contains the assumptions you made while answering your research question. In nutshell the structure of the research is reflected based on decisions. However, there is a need to justify the method we have adopted (Saunders and Lewis, 2003). This research reflects the philosophy of positivism where credible data is constructed from observed environment which further emphasize on hypothesis. Where outcomes are confirmed or testing as part or whole to determine theory. The research is structured based on the interlinks of research onion

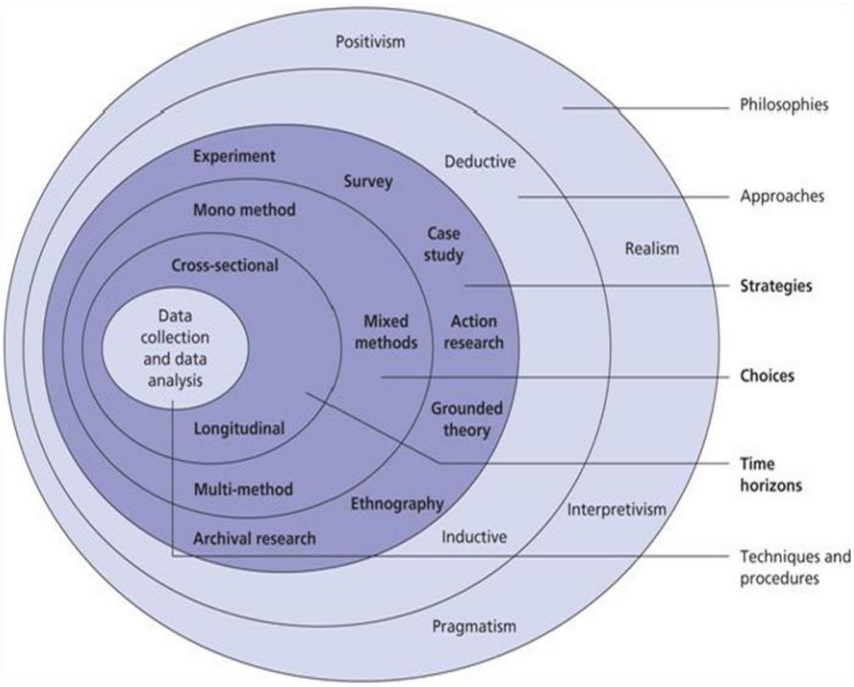

Figure 5: Research Onion Source :(Saunders, Lewis and Thornhill, 2009)

As per research onion, this piece of work emphasizes on data collected in a longitudinal manner, and through deductive approach thus, by analyzing the earlier works of literatures, the research entirely based on survey and often land up with mono- method quantitative research. As the research is conducted in real environment its nature is confined to positivism.

4.3 Research Approach

The research objectives are determined with the help of quantitative approach, whereas statistical techniques are used such as reliability test, validity test and Pareto analysis. The approach for this study is quantitative whereas survey method is used to collect data from controlled environment. The whole purpose of selecting this approach is to have opinion of individuals who had real-life contribution towards this system with the help of limited set of questions which ensures statistical collection of the data. Secondary data was gathered from the earlier works of literature conducted on ERP implementation, whereas Primary data is collected through responses from questionnaire sent to participants.

4.4 Sampling Strategy

Sampling process illustrates the justification that how judgment from a small part of the population can anticipate the result for entire population (Hennink, Hutter and Bailey, 2011). These sampling techniques are non-probability based and would need the researcher to have a judgment about factors that needed for sampling. Sometimes it can also contradict the results based on the opinion of the individual, which can cause an error due to individual biases (Delmont and Mason, 2007), The exploratory approach of this study results in understanding and analyzing problems in these systems. This study will provide solution in an appropriate manner by using a platform of this research.

There is need of analysis of new data collected from specific participants. Which further can be gathered and contributed to form a comprehensive list of factors influencing ERP implementation.

The population of the study includes consultant, project team members, ERP vendors, top management of organization and end-users from Indian manufacturing sector. The whole purpose of involvement of these groups to avoid individual biases and perception about the implementation agents. Whereas all participants play a vital role in ERP implementation.

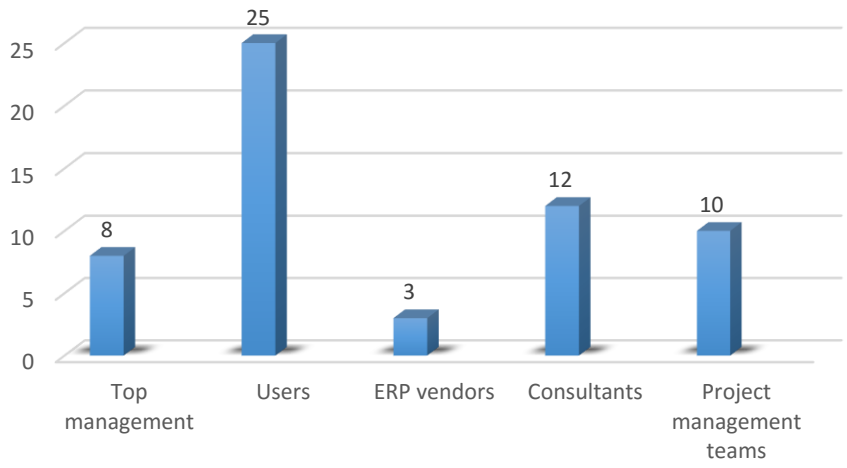

Figure 6: Participant categories and their responses

4.5 Data collection methods

The data for this study is articulated from two sources, Secondary data is collected from ealier piece of literatures which includes journals, articles, news event in recent years, magazines, reports, books and case studies, whereas primary data is collected from surveys comprises of close ended questionnaire which is circulated through emails and e-forms.

Data was collected using questionnaire based on the survey that was circulated amongst the 253 participants which includes consultants, users, top management representatives, project management groups and all user, who actively participate and are influenced while implementing ERP process. Where as these groups was confined to participants from manufacturing sectors in India.

4.6 Data Collection Instrument

The survey instrument is used to collect primary data from participants. Where pre-existing questionnaire is obtained from contacting researcher. The researcher shared the instrument and I sought full permission to use it for my research.

Instrument is used to collect the data in forms of perception of the participants about critical factor and their significant influence on ERP implementation, for these factors statement was formulated using pieces of literature on ERP.

The questionnaire comprises of three sections where I-A contains the general questions about ERP implementation; section I-B comprises of twenty questions about influential factors in ERP implementation in which nineteen discrete factors were questioned to encapsulate the degree of influence in ERP failure at Indian manufacturing sector. All questions were paraphrased to suit a five-point Likert scale to avoid inarticulate response from respondent. Another reason behind using five-point Likert scales to provide stronger validity trial using statistical analysis tools to ensure reliability of these factors, most items were adopted from the relevant literatures in ERP context.

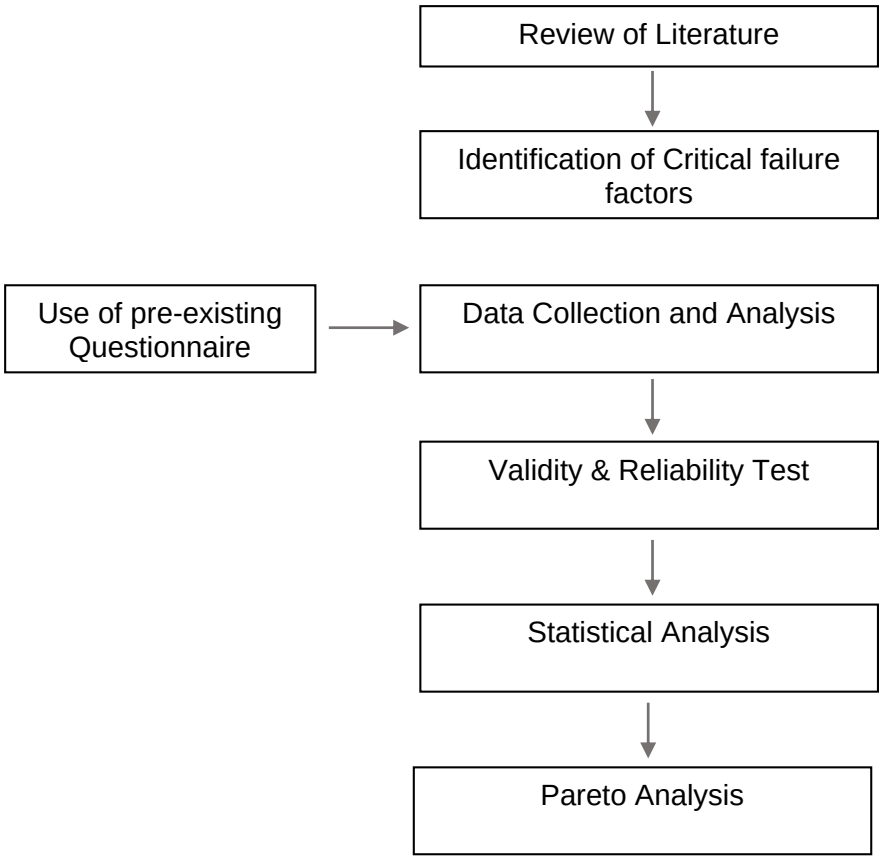

Figure 7: Instrumentation framework for methodology

4.7 Sample Plan & Size

The optimal sample size for the quantitative survey is often positioned between statistically desirable and feasible sample size (Saunders and Lewis, 2003). In general, desirable sample size is 60; however the feasibility of acquiring such a sample is very tedious due to availability and propinquity of participants. Especially the top management and ERP vendors are immersed and hard to reach, yet they contain the most valuable inputs which are essential to fill up the gap between the literature and actual industrial practices, total 58 responses acquired amongst 253 contacted participants. Continuous brainstorming through reminders and contacts the sample size was not able to acquire desirable number of responses. However, the large number of responses (17 Numbers) were ineligible due to their null implementation, no experience, different areas of implementation and excessive missing data.

4.8 Data Analysis

4.8.1 Reliability Test

Reliability test forms the propionate results by taking into consideration different respondents, this is because all the respondents differ in opinions and their answers. Though it has multiple interpretations but still the reliability test is worthy as it gives optimum results by examining the data and removing the unwanted items. Therefore reliability is carried out with the help of SPSS statistical tool. The cronbach's alpha is determined to check reliability of the respondent. According to (Kaplan and Saccuzzo, 2009) acceptable value of cronbach's alpha should be 0.7 or higher.

4.8.2 Validity Test

Validity test place a judgement that is essential to measure the comprehensiveness of the survey. Items here are selected from different sources in order to get the appropriate results. About 58 ERP consultants were examined to get the valid result with proper justification. It has specific domain and can be sure about the claim done by surveys that form the strong base in giving output. The correlation amongst the factors is analyzed with the help of SPSS v25. The degree of correlation depend on discrete factors were considered as evidence for validity.

4.8.3 Descriptive Statistics

Through descriptive statistics primary data is analyzed. Twenty questions were asked using a five-point Likert scale. Figure 5 represents analyzed data in SPSS version 25. Where Mean and Standard deviation is calculated. The questions used in survey instruments were adopted from prior research of critical failure factors in ERP implementation. Where Mean represent the degree of influential factor amongst other critical factors.

4.8.4 Pareto Analysis

Once the degree of these factors are known by evaluating all factors, some essential factors are sorted out to list the result that was required to ehance the ERP implementation process. To select the factor who has highest impact on implementation failure are analyzed with the help of Pareto analysis. The statistical data is organized in descending order from highest frequency to lowest frequency. Cumulative percentage of these factors are calculated from top to bottom where 'vital few' items occupy a substantial amount, which is 80 percent. Pareto analysis is emphasized on 80-20 rule from which vital factors are considered as Critical failure factors.

4.9 Ethical approval

It is observed that in quantitative study the data is gathered from participants to evaluate results. Where it's a responsibility of the researcher to protect the data or keep it as confidential. Where responded can choose the level of anonymity while participated in research. The data situated with their identity and organization should not be mentioned in part of the findings. All ethics related to business and human are followed, were care should be taken that there will be no risk or harm to any participant in future. The researcher is well aware about the consequences of their research and results.

4.10 Summery

In this chapter we have determined the methods by which the data for this research is gathered and structured. The tools which are used to analyze the data. And how reliable the data collection instrument was with the help of Reliability and Validity test. The pilot test was not present in this study due to use of pre-established questionnaire obtained from researcher who have studies the area with same context. Apart from that I have gained full permission to use it to determined findings for my study. In next chapter, the results from these methods is presented and elaborated.

Chapter 5: Findings

The participants in the field of ERP were contacted, which includes consultants, ERP vendors, project management team, top management and end-user. Response from them is analyzed statistically to determine critical failure factors which can influence ERP implementation.

5.1 Reliability Test

The instruments like surveys were participant's response for a variable might be different amongst other participants. Surveys are generally considered reliable if they produced similar results. Still it is not possible to have perfect correlation amongst different participants. Therefore survey instruments like questionnaire need to go through the process of modification to have highest correlation amongst the participants. In such situations, a concept like pilot test take place were preliminary survey is carried out to evaluate correlation amongst participants so that reliability of instrument can increase. The questionnaire which used is a part of previous research with identical context; due to which pilot test is not carried out.

Responses from participant are statistically analyzed using SPSS tool, were chronbach's alpha is calculated to determine correlation amongst participant. The reliability test showed value of Cronbach's alpha as 0.85. The justified limit for reliability test lies from 0.5 to 0.6. Although, in research terminologies, it is anticipated as 0.7 or higher (Kaplan and Saccuzzo, 2009). Table 3 indicates results of the reliability test.

Case Processing Summary

		N	%
Cases	Valid	58	100.0
	Excluded[a]	0	.0
	Total	58	100.0

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.855	.853	20

Table 3: Cronbach's alpha test results in SPSS v25

5.2 Validity Test

In content validity test comprehensive questions are presented that are vital to explore the survey and is necessary for the further analysis of research. The conducted research include critical factors that were proposed with the help of previous literature in ERP implementation. Numerous cases, journals and reports were analyzed to establish comprehensive list of critical factors in ERP implementation. The statistics data from these responses were represented in Table below

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	72.60	101.998	.472	.489	.848
Q2	72.34	104.826	.324	.467	.853
Q3	73.21	103.149	.311	.423	.854
Q4	72.21	106.237	.283	.651	.854
Q5	73.41	105.159	.206	.194	.858
Q6	73.02	98.614	.468	.458	.848
Q7	73.86	91.805	.656	.764	.838
Q8	72.78	102.037	.327	.629	.854
Q9	73.55	92.918	.626	.765	.840
Q10	72.74	98.160	.518	.800	.846
Q11	73.55	93.445	.636	.788	.840
Q12	72.53	105.306	.253	.474	.855
Q13	73.74	95.669	.611	.672	.841
Q14	72.79	100.658	.397	.437	.851
Q15	72.62	104.029	.345	.477	.852
Q16	72.22	105.230	.435	.615	.851

Q17	73.95	93.559	.567	.526	.843
Q18	73.03	96.525	.547	.748	.844
Q19	73.19	100.858	.367	.555	.852
Q20	72.36	104.340	.407	.655	.851

Table 4: Statistics of total entities through SPSS v25

To determine the validity of the instrument, construct validity was established by statistic data analysis through SPSS and the results of distinct factors are compared to determine the correlation between influential factors. The degree of reliability amongst this factor is used as evidence to prove the validity of instrument.

5.3 Descriptive Statistics

The research in the field of ERP implementation the conducted to determine the factors which might result in implementation failure. These factors are than illustrated as statement and represented as questions. The data collected through responses were in five-point Likert scale to avoid unarticulated response. Table 6 represents the mean and standard deviation for twenty critical failure factors. The mean of the factors are arranged into descending order to determine the ranking of the critical failure factors

	Mean	Std. Deviation	N
Q4	4.62	0.616	58
Q16	4.60	0.528	58
Q2	4.48	0.731	58
Q20	4.47	0.655	58
Q12	4.29	0.817	58
Q1	4.22	0.796	58
Q15	4.21	0.789	58
Q10	4.09	1.064	58
Q8	4.05	1.067	58
Q14	4.03	1.059	58
Q6	3.81	1.115	58
Q18	3.79	1.151	58
Q19	3.64	1.103	58
Q3	3.62	0.970	58
Q5	3.41	0.974	58
Q9	3.28	1.295	58
Q11	3.28	1.240	58
Q13	3.09	1.113	58
Q7	2.97	1.324	58
Q17	2.88	1.352	58

Table 5: SPSS statistical report in descending order

5.4 Pareto Analysis

To determine the vital few from the list Pareto analysis is conducted. Where results for the same is represented in the table below.

Q No.	Critical failure factor	Mean	Percentage	Cumulative Value	Cumulative Percentage
Q4	Lack of Top management commitment	4.62	4.62	4.62	6.01
Q16	Absence of Business process reengineering	4.60	4.60	9.22	12.01
Q2	ERP software misfit	4.48	4.48	13.71	17.84
Q20	Improper training and education / competence	4.47	4.47	18.17	23.65
Q12	User's resistance to change	4.29	4.29	22.47	29.24
Q1	Weak development, testing and troubleshooting	4.22	4.22	26.69	34.74
Q15	Inadequate project team composition	4.21	4.21	30.90	40.21
Q10	Insufficient IT maturity	4.09	4.09	34.98	45.53
Q8	Poor Vendor support	4.05	4.05	39.03	50.81
Q14	Over-reliance on Heavy customization	4.03	4.03	43.07	56.06
Q6	Tight schedule	3.81	3.81	46.88	61.02
Q18	Poor user involvement	3.79	3.79	50.67	65.95
Q19	Lack of communication / knowledge transfer	3.64	3.64	54.31	70.69
Q3	Inappropriate business & IT legacy system	3.62	3.62	57.93	75.40
Q5	Absence of monitoring and evaluation	3.41	3.41	61.34	79.84
Q9	Obscure business plan or vision	3.28	3.28	64.62	84.11
Q11	Poor consultant effectiveness	3.28	3.28	67.90	88.37
Q13	Not specified	3.09	3.09	70.98	92.39
Q7	Unrealistic expectation	2.97	2.97	73.95	96.25
Q17	Cost Over Runs	2.88	2.88	76.83	100.00

Table 6: Pareto chart-Cumulative value and percentage

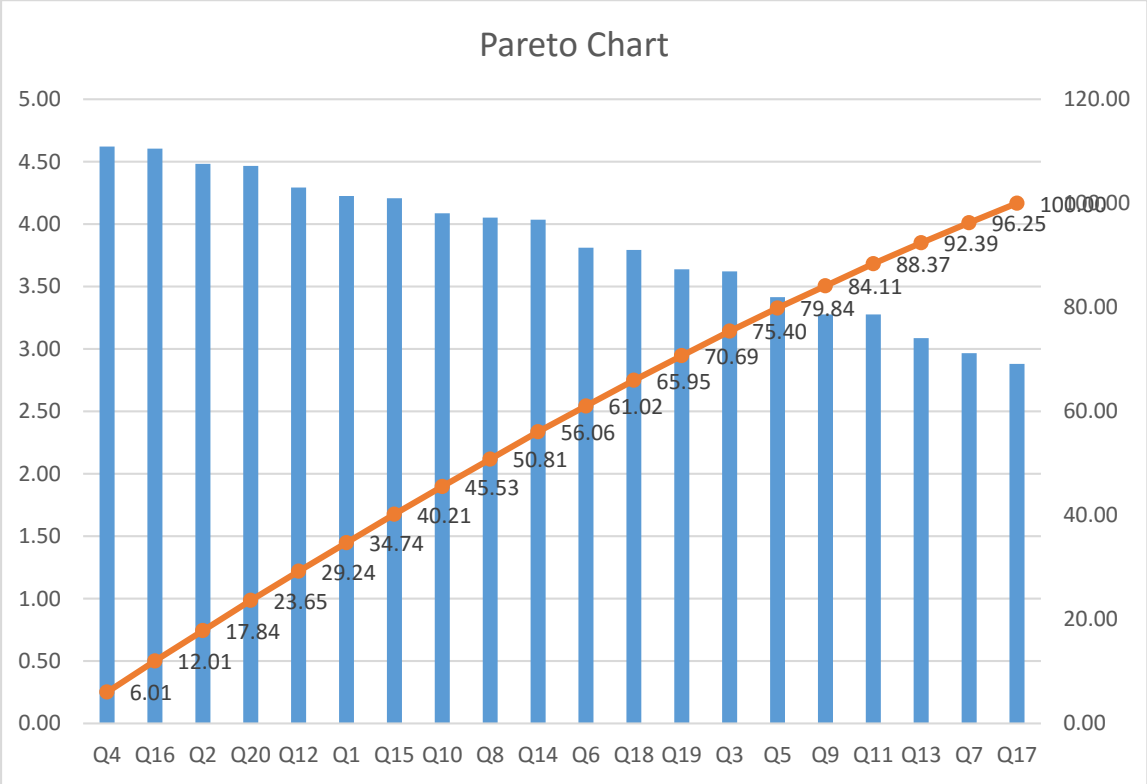

Figure 8: Pareto chart- Graphical representation

The degree of critical factors is carried out with the help of mean derived from respondent.

This mean is represented as degree of effectivity amongst other factors. Total summation value is then used to determine cumulative value and cumulative percentage. This percentage scale is used to determine Pareto scale. Where according to 80-20 rule the factors contributing to total 80 percent of failure are then considered as vital one's which is highlighted in red on Table 7.

The critical failure factors in hieratical order considered form most considered to least considered, one which is taken account during implementation of ERP system. These factors are considered as input for the pre, post or intermediate phase of implementation to avoid risk of ERP failures. The factors in hieratical order are listed below:

Sr. No.	Critical Failure Factors
1	Lack of Top management commitment
2	Absence of Business process reengineering
3	ERP software misfit
4	Improper training and education / competence
5	User's resistance to change
6	Weak development, testing and troubleshooting
7	Inadequate project team composition
8	Insufficient IT maturity
9	Poor Vendor support
10	Over-reliance on Heavy customization
11	Tight schedule
11	Poor user involvement
12	Lack of communication / knowledge transfer
13	Inappropriate business & IT legacy system
14	Absence of monitoring and evaluation

Table 7: Crucial few - Critical failure factors

Chapter 6: Discussions

A Successful ERP implementation may result in efficient business processes which can thrive an organization in highly competitive market. According to data published by International Data Corporation (IDC), ERP market in India is showing significant growth of 14 percent in 2018 (Asprion, Schneider and Grimberg, 2018). whereas SME sector of India is concentrated with manufacturing units, approximately 67 percent (IBEF, 2014). Thus ERP vendors are heavily investing in Vanilla ERP packages in that sector. Where organizations are ready to purchase these packages without considering internal context, investing in sophisticated tools like ERP can not only cost them money but also cost the efforts and resources of the organization where low return of investment can lower the morale of the employee. The organization should have systematic approach while adopting these packages as ERP adoption failure can result in disruption in business process which can harm their reputation (Chen, 2001). While IT maturity and incompetence amongst employees considered as significant factors amongst small manufacturing units they should evaluate internal resistance and readiness in pre-implementation stages (Upadhyay *et al.*, 2010). LE's where ERP system is adopted and implemented effectively due to help of external bodies like consultants and project management team were lacking integrity and efficiency (Jahanyan, Dan and Upadhyay, 2011). Implementing technical project might be challenging in Indian manufacturing industries due to inadequate support however with patience and skills any organization can achieve effective implementation.

An organization who implemented the system for instantaneous return on investment are considering these systems as failure. Misleading guidance and poor vendor support were profoundly impacted system integrity in Indian manufacturing industry. Sometimes organization approach towards system where partial integrity towards departments like Inventory, forecast and production are hindering efficiency of the system — having system awareness before implementation can avoid unreal expectations and improper deployment.

Misfit between organization and software can have collateral damage in stages of implementation. System analysis before the adoption can results in least adjustment which can reduce internal resistance for system integration. However, perfect fit between

organization and tools were impossible, which implicate the use of Business process reengineering in organization. Strategic BPR leads to system remoulding, process elimination and innovation, which awakes the hidden capabilities of firms. Consultants and top management should have prior research about the processes and operations of the firm while selecting ERP packages. Whereas monitoring, testing and control over every phase can eliminate over-exaggeration and failure at the ‘go live’ stage of the ERP implementation.

Pre-implementation stages can result in successful implementation through controlling and eliminating critical failure factors within an organization. A systematic approach towards system adoption with consecutive phases are important to eradicate misconception and non-conformities in implementation process.

Phase I: Structuring clear vision

Understanding legacy system prior to implementation of new system is crucial. The processes flow of organizations were properly mapped, evaluated and benchmarked before initiating BPR. The feasibly and need of incorporated process helps in taming expectation of the system.

Phase II: Legacy system evaluation

Prior action plan to evaluate system deficiency can be employed with the help of critical failure factors. These factors leads project towards failure, strategic steps and eradication of CFF is mandatory where changes in the system are very crucial.

Phase III: Executing plans

Elimination of the factors needs the actions to be taken by organization. Which can be in form training or proper awareness. Involvement of top management will results in effective execution.

While constructing implementation phase’s elimination of system deficiencies are done while considering critical failure factors. Where each factors plays significant role in successful deployment of ERP tools.

1. Lack of top management commitment: ERP is a tool which integrates all business process into single system. In which legacy system needs adjustment to have fit

between the software and business processes. Without intervention of top management it is very difficult to comply new policies or changes.

2. Absence of Business process reengineering: Its impossible to have fit between software and firm, therefore business process needs remolding to be integrated efficiently which can be effectively carried out with the help of BPR. Absence of BPR can cause chaos while implementing new industrial practices which will results in poor software configuration.
3. ERP software misfit: The misfit between software will results in change of business process or software customization. Both process involves significant risk of ERP failure. For example software customization can results in multiple testing and troubleshooting process which makes deployment delays and cost-overrun. However change in business processes involve heavy use of BPR which results in user saturation.
4. Improper training / education: Improper training lead to poor usability of ERP software where it unable to achieve adequate returns on investment and project will classified as failure.
5. User's resistance to change: Users play vital role in ERP implementation due to ERP packages cannot run by itself without proper insertion of data. Apart from that implementation process involves understanding user's processes however user negligence can result in poor inputs which leads in system failure.
6. Weak development, testing and troubleshooting: Weak development can results in errors in the system which can results in series of syntax errors and issue at the time of deployment.
7. Inadequate project team composition: Projects like ERP requires expertise and skills in discrete subjects. Without competence of single factor whole system canot be able to compete and results in failure.
8. Insufficient IT maturity: to run multiple business process ERP need high processing power where poor IT infrastructure will results in sluggish system performance.
9. Poor Vendor support: To implement the ERP package at its highest extend organizations need deep support of personal who designed the software. Where poor vendor supports can result in inadequate training session results in poor usability.

10. Over-reliance on heavy customization: Heavy customization will increase the need of persistent testing and troubleshooting. Which can results in user's saturation. Apart from that over-customization can results in delayed implementation which overloads vendors and users.
11. Tight-schedule: Tight schedule may arise due to pressure from top management or limited resource allocation. Where rushed environment makes mistakes while implementation and crucial phases like monitoring and testing got neglected which will results in issues at the of deplyement.
12. Poor user involvement: User's involvement will heavily impact the ERP success as they will provide valuable input for successful implementation.
13. Lack of communication/knowledge: lack of communication can results in lower integrity of department where dispute amongst the internal or external agent can results into ERP failure
14. Inappropriate business & IT legacy system: Legacy system plays vital role in ERP implementation. Without prior understanding of legacy system can results in additional process which might not essential or negligence of business process can results in system ineffectiveness.

Chapter 7: Conclusion

The aim of this research is to determine the factors which contributed in failure of the ERP system at Indian manufacturing industries. For which data is collected from literatures and group of participants. Participant group is composed of consultants, project management teams, ERP vendors, management representative and end-users who had active participation and equal contribution towards implementation success. The gathered data is analyzed to determine the key factors which frequently appears and cause chaos in the process of implementation. According to study, multiple factors that correlate with each other to create anomalies during implementation. While issues like misconception, employee morale and unrealistic expectation also incorporate risk of failure.

The determinants of critical failure factor can presumed a feedback to construct structural success model for ERP implementation. The practical approach of this study determines the internal as well as external elements which might leads implementation process towards disruption. While considering the factors towards manufacturing system in India study also defines the implementation success substantially depend on the elimination of deficiencies.

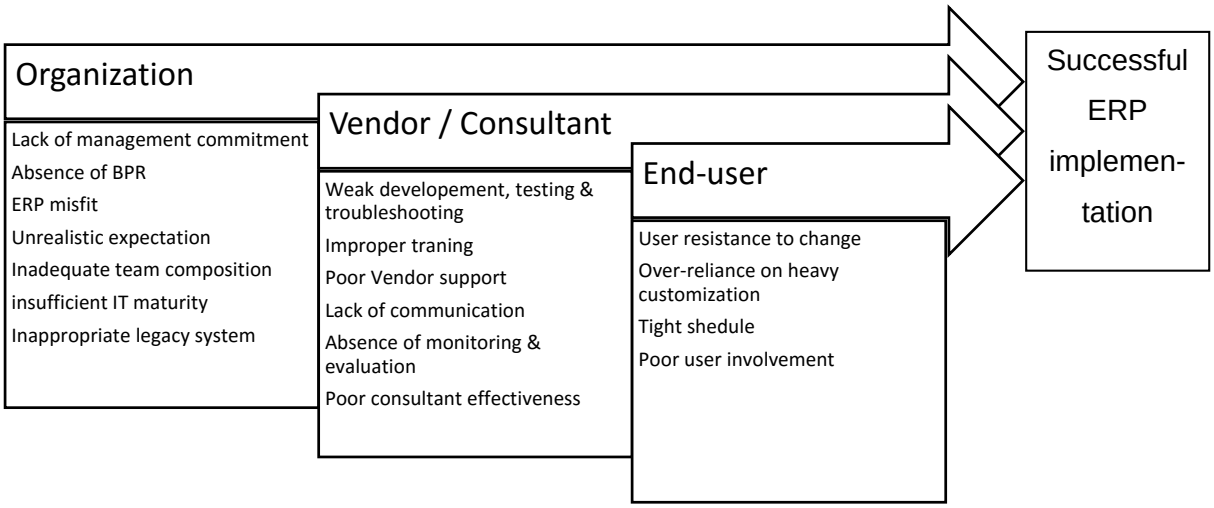

Figure 9: CFF and their association with each participants in implementation process

Understanding of these critical failure factor should provide valuable information for Indian manufacturing sector during their ERP deployment. Where chronology, nature and effect of these factors can help organizations to clear the clutter of misconception about ERP implementation. Successful implementation has direct correlation amongst elimination of these factors, where each participant plays vital role while contributing adequate data and efforts to ensure the efficient working of ERP system.

Chapter 8: Future Work

All the industries do not possess same organization characteristics and size, even the business requirement is different for every organization, thus this creates robust research environment and thus need to be considered while implementing ERP system in any firm. A confirmatory analysis can be done to validate ERP implementation and this can fulfill the future scope of research in various failure factors of ERP. Indicating the appropriate package of ERP implementation in Indian manufacturing sector future study can be emphasize on considering the stability and competitiveness of organization in the market. More study is required to be done in various dimensions of ERP implementation, that is ex post an experience-based dimension, and ex ante an expectation-based dimension for future research. Investigation of internal and external contingencies for example suppliers, government and essentially competitors, are also not considered in the thesis above, a future study can be done using the base of this thesis. Specifically, about Indian manufacturing sectors cross borders and cross-country issues are not taken into consideration, so future study can be done on this.

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List of Appendices

Appendix 1: Questionnaire

"Critical failure factor affecting Enterprise resource planning implementation in Indian manufacturing sector: A quantitative study"

Questionnaire No.__

Dear Participants,

I am inviting you to participate in this research project to survey Critical failure factors which might affect the ERP implementation in Indian manufacturing sector. The survey is a key part of an MSc (International Business) dissertation under the guidance of Dr. Colette Darcy. This questionnaire consists of thirty one questions that deal with identification of Critical Failure Factors (CFFs) for the successful ERP implementation at Indian manufacturing sector.

Based on this survey I want to understand and introduce what can be the possible guidelines and strategies for the successful ERP implementation at manufacturing sector in India. I have attached a short questionnaire about CFFs for ERP. The questionnaire is brief and will take about fifteen minutes to fill out. Guidelines for completing the questionnaire can be found on the form itself. Each questionnaire is numbered to help keep track of returns.

I promise that I will respect your privacy. I appreciate your valuable time and candor. I will make sure that your answers cannot be linked to you personally. Please be assured that all information you provide will be used for academic research only and your name or other identifying information will not appear on any part of the study report. All the individual responses will be kept confidential.

If you choose to participate in this survey please fill in your answers and send (or give) the questionnaire back to me. There are no risks to you or to your privacy if you decide to join this study by filling out this questionnaire. Participation in this study is voluntary. You can choose not to take part and you can also choose not to finish the questionnaire or omit any question you prefer not to answer without penalty or loss of benefits. Even if you decide not to participate that is fine. I will be very happy to share my results with you if you are interested.

If you have any questions about the survey, or about being in this study, you may contact me at X18147445@student.ncirl.ie. I hope you will view this as an important matter, and take some of your time to complete the questionnaire as your participation represents a valuable contribution to this research project. Thank you in advance for your time and effort in completing the questionnaire. Your help is greatly appreciated.

General Information

Participant Name_____

Participant Category
Consultant (____), ERP Vendor (___), Management (_), User (_____)
Other (_____)

Organization Name (ERP Vendor Name) _____

Number of ERP Implementation in India_____

- (Please do select only one)
  Years in ERP_____<1 , 1 to2, 2 to 3, 3 to 5, 5 to 10, 10+

- (Please do select ERP product of your expertise)
  ERP Product_____SAP/Oracle/Others

- (Please do select the Sector/Sectors for which ERP Implementation done by you)
  Implementation Area_____Manufacturing/Assembly Line/Service/Government

- (Please do type 1, 2, 3…etc for respective Sector/Sectors as applicable) Number of Project /Projects Implemented in Each Sector
  Manufacturing (__), Assembly Line (_), Service (___), Government (__)

- (Please do type 1, 2, 3…etc for respective Sector/Sectors as applicable) Years of experience in each Sector/Sectors
  Manufacturing (__), Assembly Line (_), Service (___), Government (__)

This Survey deals with identification of Critical Failure Factors (CFFs) for the successful ERP implementation at manufacturing sector in India.

While Filling This Questionnaire Please Do Consider The Following Scenario:

Country	For India (Indian Environment only)
Industry	Manufacturing / Fabrication / Automation.
Sector	For All(Manufacturing, Service, Assembly Line ,Government Etc)
Domain	For All (Finance, Marketing, HR, Production Etc)
ERP Vendor	For All(SAP, Oracle, Udyog, T-Fat Etc)

Please do consider ERP project lifecycle Start from

Planning > Implementation > Stabilization > Improvement

- Planning: Choosing the ERP package, scoping the project, formulating the system architecture, and approval of budget and schedule.
- Implementation: Configuring and implementing the ERP software.
- Stabilization: After initial implementation, a stabilization stage occurs when implementation problems are fixed and organizational performance improves.
- Improvement: Achieving the benefits, updating new modules, focusing on Continuous improvement and transformation.

CFFs: Critical Failure Factors define as the key aspects (areas) where "things might go wrong" in order for the ERP implementation process to achieve a high level of success.

IA: In part IA please do select the box which best represents your opinion (Select only One Box for each Question).

IB: In part IB please identifies the Critical Failure Factors (from question one to twenty) that are critical for all the phases of ERP implementation (planning, implementation, stabilization, and improvement) at Indian manufacturing sector.

IC: In part IC please list any other critical failure factors which are missing in questionnaire but that may contribute in the successful ERP implementation.

(IA and IB) Identification of Critical Failure Factors (CFFs)

According to the literature review there are few Critical Failure factors (CFFs) which can obstruct successful ERP implementation in manufacturing industries those are not only internal and enterprise specific(controllable) but it includes external factors too(uncontrollable). Identification and understanding of these factors from the ERP consultant's /vendor point of view may help in successful ERP implementation at manufacturing sector in India as it may help in controlling the risk of ERP failure at Indian SMEs. Factors that comes under enterprise and person's individual jurisdiction of control, if identify correctly can helps in formulation of proper ERP implementation strategy along with the maintenance for the successful ERP implementation.

Please do select the box which best represents your opinion (Select only One Box for each Question).Your point of view will be kept confidential and will be used for academic research only.

✓

(IA). Please do read the following statements and tick ( ) in appropriate box to express your degree of agreement or disagreement regarding your views about Critical Succes Factors (CSFs) for the successful ERP implementation at Indian SMEs. Please do not omit any item	YES	NO
Does different size of enterprise influence success of ERP implementation?		
Does employee of the enterprise influence success of ERP implementation?		
Does technology used influence success of ERP implementation?		
Does selection of ERP vendor/ERP products influence success of ERP implementation?		

I-B, Questionnaire

Please do select the number in the box which best represents your opinion for the Critical Failure Factors (CFFs) that results in the failure of ERP implementation at Indian manufacturing sector on a scale of 1 to 5. (Please Select only One Box for each Question).

1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

✓

(IB).Please do read the following statements and tick( ) in appropriate box to express your degree of agreement or disagreement regarding your views about Critical Failure Factors(CFFs) for the failure of ERP implementation at Indian SMEs Please do not omit any item.	Scale				
1. Poor quality of testing not only waste time and resources of the enterprise but also results in the implementation failure.	1	2	3	4	5

2. ERP Vendor or package misfit can be results in ERP implementation failure or dissatisfaction at Indian manufacturing sector.	1	2	3	4	5
3. Implementation can results into failure if the legacy business system doesn't match with the new business processes	1	2	3	4	5
4. Lack of top management support leads to many problems and ultimately in the failure	1	2	3	4	5
5. Absence of testing, monitoring and troubleshooting can results in poor quality of package at later stages	1	2	3	4	5
6. Too tight project schedules leads to the stress and poor quality of ERP implementation.	1	2	3	4	5
7. Unrealistic expectation of top management and enterprise from the ERP Implementation without considering complexity leads to dissatisfaction.	1	2	3	4	5
8. Lack of knowledge transfer from vendor before and after ERP implementation leads to dissatisfaction amongst users.	1	2	3	4	5
9. Lack of formal strategy leads to uncertainty and confusion during and after the ERP implementation.	1	2	3	4	5
10. IT maturity plays significant role in ERP implementation as lack of IT infrastructure will lead to deficient ERP functions.	1	2	3	4	5
11. Incompetence and inexperienced consultants may results in the failure of ERP implementation at manufacturing sector in India	1	2	3	4	5
12. Users resistance to change can have collateral damage to ERP implementation.	1	2	3	4	5
13. Any ERP implementation can't be consider as successful if it doesn't provide the required functionally of the business	1	2	3	4	5
14. Too much software modification increase complexity and failure risk along with the maintenance cost of the ERP implementation.	1	2	3	4	5
15. Improper project management and poor resource utilization may results in the failure of ERP implementation.	1	2	3	4	5
16. Poor and Inadequate business process reengineering can be results in failure of ERP implementation.	1	2	3	4	5
17. High cost of ERP implementation considered as the failure of ERP implementation if it crosses the budget of an enterprise.	1	2	3	4	5
18. ERP implementation at manufacturing may get fails due to part time dedication of team members and their less involvement.	1	2	3	4	5
19. Lack of formal communication leads to misunderstanding and results in the failure of ERP implementation.	1	2	3	4	5
20. Unclear concept of the nature and use of the ERP system among users are the result of insufficient ERP education and the training	1	2	3	4	5

"Others (please specify)" IIIB- Please do list any other Critical Failure Factors(CFFs) which are missing in above questionnaire but that may contribute in the failure of ERP implementation at Indian SMEs.

Thank you for your Cooperation!

Thank you for your participation. I appreciate your valuable time and candor.

I sincerely thank you for your valuable time and very useful information which will help me with a great deal in MSc dissertation. I assure you complete confidentiality of the information given by you.

Sincerely,

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